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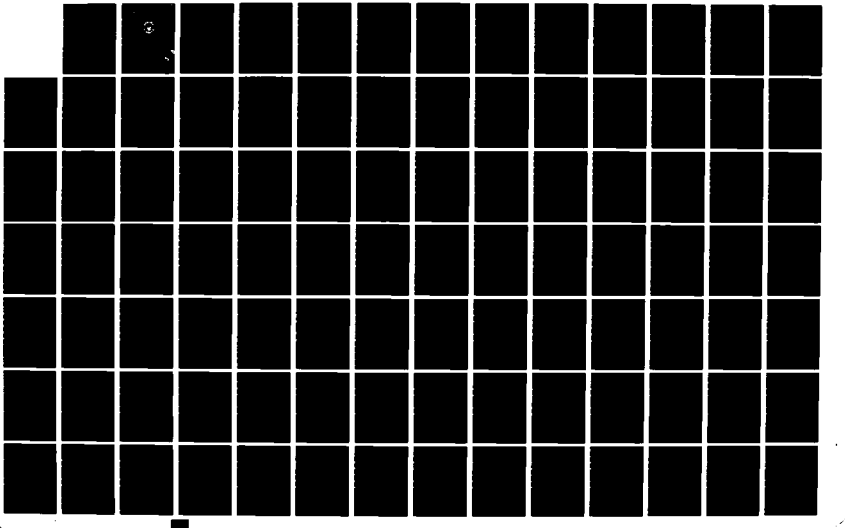

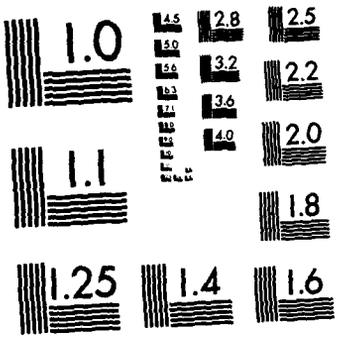

NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

PROSPECTIVE MODEL AND ITS METHODOLOGY
OF SUPPLIES FOR THE REPAIR AND MAINTENANCE
OF THE VENEZUELAN NAVAL SHIPS
TO THE THIRD LEVEL

by

Jesus B. Vivas

June 1982

Thesis Advisor: J. W. Creighton

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Prospective Model and its Methodology of Supplies for the Repair and Maintenance of the Venezuelan Naval Ships to the Third Level

by

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Submitted in partial fulfillment of the
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ABSTRACT

This work provides a prospective model for optimizing production and reducing operational costs in the "system of provision of supplies," with the goal of effecting maintenance and repair in Naval Units up to the Third Level. It shows that the development of a system of supply of spare parts and equipment will be effective, operative and dynamic within its referential framework. The functions of maintenance at the Third Level, and its role in the integral development and operations of the Navy, are clearly defined. This study does not delve deeply into analytical methods and techniques to establish the category of maintenance most adequate for each equipment and/or system. Rather the object of this thesis is to illustrate the procedure to systematize the supply of materials, be it that of initial procurement or that which must be maintained in inventory to support the operational effort of maintenance at the Third Level for the Venezuelan Navy.

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To all, my deepest appreciation for their patience and assistance.

With hope that the ideas and experiences collected here will be of use to those who enter the world of maintenance.

I. INTRODUCTION

This thesis is comprised of objectives and requirements from three institutions. Above all it responds to the academic norms of the Naval Postgraduate School, as a master's degree thesis; in a second instance it would contribute, if deserving, to the Navy, where the writer serves as a professional officer; and thirdly, the investigation must offer some programatic expectations to DIANCA, the company which affects maintenance to the Naval Fleet. Finally, for the writer, the study constitutes a true challenge upon the applicability of logistical criteria to managerial strategy; a situation that should not surprise us since all social groups in many instances have faced situations with strategic characteristics and have had to reason, decide and plan to overcome adverse contingencies or to simply find valid alternatives in an "is" or "should be" situation for the purpose of attaining the desired goals.

This interlacing of requirements from different institutions, and the short term allowed for the realization of the thesis brought about the need to develop a prospective model which suggested and determined a special methodology whose congruency and consistency of the information obtained responds to a great desire for optimization of logistical activities.

The increasing developmental complexity of countries that are highly technical and the constant progress of countries on their way to full development require new administrative alternatives for management of projects regardless of their size.

The complicated operational and administrative problems existing today in modern organizations have greatly increased difficulties in conducting institutions such as the Navy, inducing its high level staff to adopt systems that are more highly scientific each time to ensure administrative success with absolutely economical criteria; an optimum utilization of human, financial, supply and technological resources.

This thesis is oriented toward the establishment of a prospective model that will lead to the best formula for optimizing production and reducing operational costs in the "System of Provisions of Supplies," with the goal of affecting maintenance and repair in Naval Units up to the third level.

We are conscious of the fact that the application of an administrative system of this nature cannot be implemented simultaneously in the entire Navy because the organizational structures and the existing operating procedures of the Navy are well established. Therefore, for the development of this model we have chosen a single administrative unit, which is

the Supply Division through the Acquisitions Division, to serve as the pilot for the determination of advantages and disadvantages of this administrative technique. It is my intention to limit the expressed problem to the mentioned Division and to apply to it a proposal whose benefits, if they exist, can be irradiated to the best of the Supply Division.

New administrative focuses, be they private or public sector, have principles and procedures that are identical.

Conclusions reached by investigators coincide in pointing out that the basic components of the administrative process do not differ much when they are applied to organizations with different objectives. Such an observation proves the universality of administrative principles.

The primary objective of administration consists of planning, organizing, directing personnel, obtaining and distributing human resources as well as financial resources to attain fixed goals.[1]

The administration of the Naval force does not differ from others. However, we cannot state that there is total and absolute identification of approaches and scope according to the field in which it develops.

The social reality in which we live demonstrates that the same processes applied in different sectors of human

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[1] Principles of Administration.

tasks bear totally different goals. In this sense, the Administration of the Navy possesses its own characteristics, has objectives and exclusive actions and an environment of particular operations. Communication, decisionmaking, programming, coordination and planning in the Navy have as its aim to "guarantee sovereignty on the maritime frontier and in Venezuelan Territorial waters, exercising controls of the contiguous zone and the continental shelf."[2]

The recognition of these differences will allow us to reach some considerations regarding the evolution and course of the administrative task in relation to the functions that must be met by the Navy.

A first look at the focus that the different schools of administrative thought gave the process allow us to classify, taking as basic criteria, the aspects of the administrative process that these emphasize.

The theories that fundamentally accentuate the procedures were placed in the first group. The primary objective of the administrative function is to gain greater results in the least possible time and in this manner achieve an optimum relationship between costs and benefits.

This rationalization of effort is reached through the use of technical methodologies and procedures that attempt

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[2]Ministry of Defense, Naval Headquarters Staff.

to analyze and simplify human behavior in the different operations that are involved in an activity.

The theories that emphasize human aspects of the task were placed in the second group. The basic factors now are persons as it is the context that will allow them a more adequate professional and human realization. In this framework, efficiency and adequacy between objectives and activities would be consequences of the creativity and operational capability of the group. The methodologies and procedures are at their service with the aim of assuring the best results of the objectives.

The human and personal dimension that is assured the force requires the determination of the creativity and personality of their direct responsibilities. The focus given to the model does not decrease the importance of technical aspects of a rational administration, instead it modifies its relative value in the total process. Science and technology must be instruments in the hands of human beings, who must be able to use and develop them in accordance with the finalities of the action.

In this sense, the need for promoting the incorporation and utilization of modern techniques in rationalization, analysis and control of operations by Naval Administration is pointed out.

To this end, overcoming the resistance observed everywhere to the introduction of new technology applied for the

efficiency of economic enterprises and the production of goals should not be applied to the administration of a firm such as the Navy. The results directly reflect the development, destiny and defense of the sovereignty of the nation. If we accept that the Supply System must respond to the DETERMINATION OF NEEDS and the requirements of optimum maintenance to support the operation of armament systems, the system must have a structure that is flexible and dynamic arising as a consequence of these needs.

Through these points of view we are emphasizing the need to achieve changes of attitude and scope with respect to conception, knowledge and the application of specific technology in Public Administration.

A great part of the failures of administrative technology stems from the formation of Human Resources and the simultaneous growth of scientific knowledge. Keiksberg stated, "The generation of Administrative Technology that can satisfy the corresponding needs of the public sector constitutes a type of process that necessarily must be operated by human porters, identical is the situation appertaining to the transference of administrative technology.[3]

The availability and quality of the affected resources in these processes must conform, since one of the principal

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[3]Keiksberg, B. "Notes for a Latin American Strategy in Superior Formation for Public Administration." Editorial Monte Avila. 1977.

determinants of the "Ceiling of Efficiency is achievable in both."

Planning/administration, being a medium available to the development of any system or enterprise -- at the same time an operative instrument -- the methodologies employed and the focuses that support them have transitory validity. Therefore, there are none, nor can there be sole routes, infallible methodologies nor finished models.

The stature of the company administrator will be given by the creative sense he will imprint in his action. In this, as in other spheres of the Navy, investigation and experimentation are called upon to open new horizons in this field.

In synthesis, as a corollary, we can assure that conducting the development of a system of supply of spare parts and equipment will be effective, operative and dynamic in the measure in which their referential framework, the functions of maintenance at the third level and its role in the integral development and the operations of the Navy, will be clearly defined. The visualization of supply of materials in a prospective model constitute a valid methodological focus to undertake the task and give it a cause for suboptimization, since our model considers a segment of the total enterprise and determines the necessary conditions for optimizing this segment.

Finally we would like to state that the study does not delve deeply into analytical methods and techniques to establish what category of maintenance is the most adequate for each equipment and/or system, since the object of this thesis is to illustrate the procedure to define supply of materials, be it that of initial endowment as well as that which must be maintained in inventory to support the operational effort of maintenance as the third level for the Navy.

II. FORMULATION AND DELIMITATION OF THE RESEARCH PROBLEM

A. TITLE

"Design of the system of supply for materials for the dock and shipyards of Venezuela, in order to effect maintenance and repair Naval Units up to the Third Level."

B. GENERAL CHARACTERIZATION OF THE EMPIRICAL CONTEXT IN WHICH THE PROBLEM IS EXPRESSED

Venezuela is a maritime country; the length of its coastline causes it to be vulnerable to uncontrolled penetration by foreign invaders. The mission of the Venezuelan Navy is to protect traffic and communication on its seas, lakes, and rivers; to guard and defend its territorial waters, the continental shelf, the neighboring zone, its exclusive economic zone, coastline, lakes and rivers so that, in conjunction with the other branches of the armed forces (the National Guard, Air Force and the Army), the sovereignty and integrity of the nation can be guaranteed while simultaneously contributing to its development.

The protection that must be provided to maritime traffic and to the focal points of production requires the constitution of an adequate naval force integrated by submarine forces, anti-air and surface capabilities with the capacity to effect amphibious operations.

This Naval force must be capable of receiving the necessary logistic support in different locations of the Venezuelan coastline for the purpose of fulfilling the assigned mission, justifying the establishment of strategically located Naval Bases and Naval Stations.

Venezuela, a country with an extensive coastline where the most important focal points of maritime traffic are located in zones near its borders and with the existence of invaluable natural resources on its continental shelf, requires an effective vigilance on the part of the naval force to ensure the defense of its interests. This Naval Force must remain at optimum conditions and in full operational capacity at all times.

Awareness of these facts has prompted this thesis, in which we wish to develop the design of the model, stressing the problem of provision of materials for maintenance at the Third Level (that which is used in dry dock). The Venezuelan Navy is required to effect maintenance and repair of its units at DIANCA[4] which must be done promptly and at an acceptable cost.

The existence of a good system to supply material at DIANCA is imperative to expedite repairs and maintenance.

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[4]DIANCA: Digues y Astilleros Nacionales Compania Anonima. Acronym used to signify company called National Dams and Shipyards Company, Ltd.

Failures in the material supply systems contribute to cost overruns.

The following deficiencies are evident:

- The inadequate inventory of stock for spare parts at DIANCA.
- The existent stock often does not correspond to the needs of the ships.
- There is no existent listing of standard materials; those which can be used interchangeably among ships.
- It is frequently necessary to order spare parts from the manufacturer after verification of need.
- For a variety of reasons after the order is placed delivery of these spare parts is often delayed, up to eighteen months.
- Costs are high because parts are not readily available in the competitive market.
- Orders are normally placed through intermediaries who increase the real costs.
- The lack of personnel qualified to repair on-board equipment often requires bringing in specialists to meet this need.
- Cost overruns are experienced when equipment or machinery is dismantled while waiting for spare parts. Extreme caution is required to preclude lost parts or deterioration while dismantled.
- The degree of demoralization suffered by the crew when the importance of speedy repair to the unit is stressed is normally translated into strong criticism of command and command divisions.

C. DESCRIPTION OF THE PROBLEM

1. Important Factors for Consideration

a. Maintenance

We can define maintenance as the function which has as its goal the conservation, repair, and the recuperation of all materials employed by the navy in peacetime as well as in war. To this end we must distinguish four levels, although in this specific thesis we will work only up to the third level.

In the first three levels two areas are common, the first one being a preventive character, the second corrective.

(1) First Level

Preventive and corrective maintenance that is carried out by on-board personnel, utilizing tools and spare parts carried on-board. This level of maintenance can be carried out away from logistic bases.

(2) Second Level

Preventive and corrective maintenance that is carried out by base personnel utilizing on-board and base tools, instruments, and spare parts. This can also be carried out away from the bases as long as the spare parts, documents, and tools are available.

(3) Third Level

Preventive maintenance at the "overhaul" level, periodic and corrective (consists in dismantling

the equipment and verifying parts that must be replaced). This level is carried out at the bases with special instrumentation and tools and with specialized personnel. The goal is to guarantee the high quality, not obtainable at the other levels.

b. Requirements for Optimum Maintenance

In order to reach the desired objectives it is necessary to adequately rationalize the following elements with regard to proportion and time:

(1) Human Resources: Administrators, Technical and Operational Staff.

(2) Finances: Operational development budget.

(3) Material Resources: Trial equipment, tools and spare parts.

(4) Procedures: Utilization of technical operational homogeneous criteria for a structurally sound maintenance program.

The combination of these factors should stimulate continual study and evaluation, feedback, and suggested modifications for program optimization, keeping in mind new armament systems or equipment to be modified or incorporated into the navy.

2. Determination of Needs

In the above paragraphs we have provided a general description of functional "maintenance," which is the foundation for the demand on spare parts and, therefore, is the activator of its binomial compansion: the functional supply element.

The term "DETERMINATION OF NEEDS" is used to designate the task of determining the optimum levels of stock to support the operation of the armament systems. This task of needs determination is not exclusive in the military environment, but it is also carried out in industry and commerce.

The armed forces of the industrialized countries have developed methods for efficient optimization of inventory levels. Ideally, the manager must have an appropriate amount of material at hand when these are required, neither too much nor too little. In general, the problem includes maintenance of level of provision at each required level of supplies and the evaluation of these levels of maintenance so that:

- The spare parts are supplied when and where they are needed.
- Stock inventory is kept at a minimum, in direct relation to needs.
- Supply transactions (including purchases, inventories, demand, etc) should be controlled by type as well as by frequency of use.
- Levels of supply will be maintained at an appropriate level to satisfy demand and preclude paralysis of the system.
- Overstock is avoided since it causes an unnecessary investment in spare parts, which may never be needed. This also will preclude unnecessary purchasing functions. Overstocking would require additional space for storage, transportation, and use of personnel overloading storage. Eventually that stock will become obsolete and must be removed at a loss.

- The prospective model will consider topics related to the organization of supply in accordance to needs.

a. Selected Factors or Variables

(1) Relevance of the Value of Maintenance

- Guarantee satisfactory operation of equipment.

- Contributes to affording adequate, opportune, permanent and continual training of the crews.

- Modification and changes in equipment guarantee an efficient, dependable and constant support during offensive and defensive operations.

(2) Relevance of the Value of Supply and the Determination of Needs

- The determination of needs is the central problem of supply. Ideally the manager must have the appropriate supply inventory, as required.

- If the levels of supply are too low, the system cannot satisfy demand; therefore, costly armament systems are paralyzed no/or combat forces are reduced to ineffectiveness.

- If the levels of supply are too high, there is unnecessary expenditure of funds and a series of administrative problems surfaces.

- Broadly speaking, the problem includes levels of provision at levels of supply and the evaluation of these services so that:

  . The spare parts are made available when and where they are needed.

  . Supply costs are kept at a minimum in in relation to needs.

. Supply transactions (including purchasing, inventories, documents, etc.) must be controlled by type and by frequency.

D. MAINTENANCE LIMITATIONS RELATING TO SPACE AND TIME

In order to establish a maintenance system, an analysis of equipment use, system and units with relation to the mission to be accomplished (hours of operation required of equipment during a predetermined time period, i.e., one year) must be developed.

This analytical process is of an eminently dynamic and interactive character, therefore, providing an adequate informational description of technical documentation, of spare parts requirements, allocated equipment and of the actual maintenance concept. In other words, we are referring to the logical foundation upon which the support required by a project of this nature will rest. Our investigation will deal with a diagnostic stage at the third level, which will guarantee that upon completion we will be able to employ the fundamental concepts previously stated with a high level of confidence.

From the onset we will process information based on the development of an operational flow chart that will graphically display the steps required to effect maintenance at the third level from the time spare parts are obtained to begin work and avoid delays. The flow chart will emphasize

the following aspects: requirements for administration, time allocation, and human and material resources required.

The diagnostic analysis and the information displayed by the flow chart will allow us to design the proposed model. The diagnostic phase will be accomplished by means of a survey and a questionnaire that will provide fundamental information for the consideration of variables discovered.

E. OBJECTIVES

1. General

- To design a system for optimum maintenance and supply that will contribute to improving operational conditions at DIANCA.
- To increase the knowledge of personnel charged with control of warehouse supply.

2. Specific

- To determine internal and external factors that affect maintenance and supply material, in order to improve procedures.
- To reduce repair costs to a minimum so as to preclude the use of intermediaries.
- To streamline entry of Naval units into dry dock when maintenance to the third level will be carried out.
- To obtain adequate, timely and precise information regarding the requirement for spare parts.

III. THEORETICAL STANDARD

A. THEORETICAL-ANALYTICAL CHARACTERIZATION

DIANCA was created by decree on August 20, 1975.[5] However, it has never operated fully toward the promotion and development of the Naval industry within the country because of the following factors:

- Most of the ships are owned by the Merchant Marine (Oil, Cargo and Fishing) and by the Navy (Patrol Boats, Frigates, Submarines, etc.). It is often advantageous to secure service elsewhere.
- The inability to serve adequately the numerous foreign ships that reach Venezuelan ports.
- The unavailability of qualified technicians, both native and foreign.

It is well to remember that the goal for the creation of DIANCA and its actual structure is to provide the Navy the necessary logistical support as established by law, DIANCA, Article 4, Chapter 1, which states: The DIAN[6] will be primarily responsible for the construction and repairs of ships and embarcations as prioritized by the administration, particularly with regard to the units and services of the Navy.

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[5]Official Communication, Republic of Venezuela. Numbers: 30771, 30774. 30 Dated August 21, 1975.

[6]DIANCA, op. cit. Acronym for DIANCA, 1917, at the time of its creation.

We are fully aware that in comparison to other industries and the capital invested, a stable market is required in addition to specialized technical personnel. This is not the case with our present incipient level of naval industrial development, both at the civilian and the military levels. DIANCA has, in Puerto Cabello, a modern dry dock with a capacity for ships up to 30,000 metric tons. It is not used to capacity because basic complementary installations are lacking, particularly in the area of repair shops, cranes and auxiliary equipment.

The repair shops are located eight kilometers away from the principal work zone. This is a disadvantage for prompt execution and economical handling of repairs. Additionally, they are antiquated, and cause delays in naval repairs where time is an important factor. The country has four small industries that are mostly dedicated to naval activities and to fishing fleet construction and sport of lesser tonnage. These small industries are unable to lend support to the Venezuelan Navy because they can only accept work orders within their limitations and because they lack specialized personnel required to augment production.

B. CONTRIBUTING FACTORS TO THE UNAVAILABILITY OF SPARE PARTS

The Venezuelan Navy Supply Division does not possess a budget commensurate to the needs of the Navy to maintain

the necessary levels of spare parts if an established program for maintenance at the Third Level were to exist.

Figures 1 and 2 are budgetary graphs depicting allocations from 1977 to the present that support the evidence presented. Additionally, 8.85 percent of the national budget was allocated to the Navy, an equivalent of 449,023,700 Bolivares (US $104,912,079.44); 4.14 percent of this amount was allocated to Item 376, Unit Repairs Section.

In 1978, the national budget allocation for the Navy varied with an accompanying decrease of 24,205,500 Bolivares (US $5,655,491), a situation that naturally affected item 376.

1979 brought about an increase in the Navy budget of 21.43 percent over the previous year. In spite of this increase, item 376 was reduced from 3.91 percent to 3.10 percent of the budget allocated to the Navy. Obviously units suffer greater deterioration with increasing age and repairs require greater expenses.

Puerto Cabello is considered the focal point for the entire nation, as a source of employment in the maritime area, creating qualified personnel which is a vital support in the socio-economic development of a nation. It is worthy of mention to state that DIANCA presently employes approximately 1315 persons.

Strategic factors are also relevant. The permanence of ships in Venezuela contributes to its security, should

1977/1979 Venezuelan National Budget and Naval Budget

Figure 1

Figure 1 Shows the Venezuelan National & Navy Budgets

(in Millions Bolivares/Dollars)

Year	1977	1978	1979
National	Bs. 50,693	Bs. 49,662	Bs. 46,540
	US $ 1,184	US $ 1,160	US $ 1,087
Navy	Bs. 449	Bs. 424	Bs. 515
	US $ 104	US $ 99	US $ 120
Percentage of national budget allocated to the Navy	8.85%	8.55%	11%

Source: Approved national budgets for 1977-1978-1979.

Figure 2

Additional Loans for Maintenance

(Millions of Bolivares/Dollars)

Year	1977	1978	1979
Navy	Bs. 449 US $ 104	Bs. 424 US $ 99	Bs. 515 US $ 120
Item 376 conservation and repair of public safety and military equipment	Bs. 18 US $ 4	Bs. 16 US $ 3	Bs. 16 US $ 3
Percentage of the budget allocated to Item 376	4.14%	3.91%	3.10%

Source: Approved National Budgets 1977-1978-1979 plus Additional Loans

the need arise or the sovereignty of the nation be threatened. It is far simpler and more advantageous to prepare and arrive at combat readiness if ships are there rather than abroad.

The contribution of industry to the defense of the nation must be considered. Industrial strength in support of the maintenance goals of the National fleet plays a heavy part in the strength and security of the nation.

National security, in a world of autonomous political units, can be based on the weaknesses of rivals (total or partial disarmament) or in strength itself. If we assume that security constitutes the ultimate political goal of nations, the most efficient means shall be to establish its POWER BASE or to modify its existing military strength so that potential enemies are not tempted to take an aggressive initiative.

The relationship between these two terms -- security and strength -- poses multiple problems. At a first level it will be necessary to observe that the maximization of resources is not equivalent to the maximization of security. In traditional Europe, no state could increase the size of its armies nor increase its riches without awakening the fear and envy of the other nations, thereby provoking with time the formation of a hostile coalition.

In a given system an optimum strength exists that cannot be overlooked without provoking a dialectic inversion. An

augmentation of strength brings about a relative weakness due to the transference of allies to neutrality or from neutrality to the opposite force.

If security were a primary objective it would be possible to theoretically determine rational conduct. One would attempt to determine the optimum strength at each juncture or for each consequence.

A difficulty emerges when one questions the relationship between two objectives: strength and security. Undoubtedly, mankind collectively or individually wants to survive. The individual, however, does not subordinate his wishes to the passion for living. Causes exist for which an individual runs the risk of death.

The same thing occurs with collective units. These do not want to be strong simply to discourage aggression and enjoy peace, but to make themselves feared, respected or admired. Ultimately they want to be powerful, capable of imposing their will on neighbors and rivals and to influence humanity and the future of civilization.

The two objectives are inter-related: the more strength acquired, the greater the risk of being attacked. One finds, however, in that same strength and in the ability to impose one's will on others, a satisfaction that has no other justification.

To possess commercial control of a determined maritime generates rivalries of an economic character with other

countries. While there is an excellent market for all, these disagreements can be resolved amicably, but as one of the nations begins to monopolize the market, rivalries are created which are in time dealt with by other means even apporaching a state of war. This justifies preplanning defense strategies that will respond to the potential hypothetical war needs. These plans must present several alternatives that can be applied to any conflict which might occur. Policies must be supported by political power in accordance to the economic obligations of the nation and the treaties and agreements signed with other nations.

The Caribbean basin is an arena of great magnitude in guaranteeing traffic for normal national development. It has required sea lanes that provide access to this sea to and from the Atlantic Ocean, toward the Caribbean Islands and the Panama Canal.[7]

These are vital points in considering freedom of Venezuelan maritime communications. There are also strategic points in the Gulf of Venezuela, the midwestern coastal zone where the entry into Lake Maracaibo is located, as well as Amuay, Punta Cardon, Aruba and Curazao. The mideastern coastal zone is Puerto La Cruz, Cumana, Carupano and the Island of Margarita.

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[7]Mentioned as strategic areas in the 1980 budget prepared by the Navy Executive Staff.

The nautical boundaries with Holland and the United States, the in-process negotiations with Colombia, the Dominican Republic, the Caribbean Islands and Trinidad and Tobago, provide the nation with an area of approximately 950,000 square kilometers, sea and submarine exclusive economic zone, an area larger in size that the territory of Venezuela. This entire area is rich in marine resources as well as minerals, and hydrocarbon and other sources of energy that require classification, vigilance and protection.

The Venezuelan Petroleum Company is presently carrying out explorations in the area of Vela Inlet, the Trieste Gulf and the Barcelona Inlet, Norte de Paria, the Orinoco Platform, the Gulf of Venezuela and Paria Gulf.

Naval strength is one of the components of a nation's maritime power and its functions and tasks are: To avoid piracy and transgression on the continental shelf by international treaties, and adequate plans and policies. Following is the defense hypothesis.

C. HYPOTHESIS FORMULATION

1. General Hypothesis

Design a system of supply at DIANCA with the goal of effecting maintenance and repair for naval ships up to the third level.

By analyzing the internal and external factors that make up the threat, we proceeded to elaborate the following

hypotheses at present: The lack of spare parts in the DIANCA warehouses, the naval ships and in the Navy reduces the efficiency of repairs up to third level for Venezuelan Navy ships.

The present budgetary structure precludes planning on short, medium and long range terms to effect maintenance and supply up to the third level for Naval ships. Higher cost is thus generated by the longer dry dock time.

Personnel working at DIANCA are not familiar with the norms and procedures for adequate purchase of material.

Three phases of the study: (a) Theoretical Overview phase; (b) Technical-Operational phase; (c) Contrast phase.

2. Theoretical Overview Phase

As the first task of this initial phase, we attempt to complete a tentative exploration for the purpose of achieving a first approximation regarding the problem area to be considered. Simultaneously, we are attempting to create a dimension regarding the possibilities for realization of the research project itself with relation to accesibility of information.

The general context of the problem is located in the area of supply for maintenance of ships of the Naval fleet. From many ideas, we selected and formulated the problem, focusing on the area of maintenance up to the third level.

A bibliographic study was conducted previously and applicable materials as well as consultants were chosen. Concentration was on new approaches and concepts recently developed in the field. A list of the existing information related to the problem was compiled. A support system for the theoretical phase of the study was documented. This portion of the study was further enriched by the design of a survey for opinion interviewed specialists. Approximately twelve consultations were also conducted at different levels at DIANCA as well as with the Navy (by telephone) with specialists and other persons intimately familiar with the supply/maintenance problem.

Resources required and other factors were studied with direct relation to this project such as: Economic resources, available materials, time availability, accessibility of sources of information for interviewing personnel involved.

Finally, the survey was designed and developed (Appendix A). Compilation and processing of the acquired data were completed.

A conscious analysis of these factors allowed us to reach the conclusion that the proposed research could be done. Specific hypotheses and objectives will now be considered.

3. Technical-Operational Phase

A series of informational interviews was conducted (by telephone and correspondence) at Naval levels as well as at DIANCA to obtain the requirements for the study. Based on positive results, development of the schematic (Appendix B, Graphic 1) to allow us to emphasize certain phases of the investigation.

a. The survey was divided into four sections:

(1) Personal Data

(2) DIANCA functional structure

(3) Budget and Cost

(4) DIANCA controls. With a total of 23 items of which four are closed, five are intermediate and fourteen are open.

The instrument was extremely useful for gathering economical information in a simple manner. It was completed by 94 employees, or 20% of the 470 employees at DIANCA.

b. Interviews

An open interview model was used. Thirty-three interviews were conducted: six officers, eight non-commissioned officers and ten civilians employed by the Navy.

At DIANCA nine high level employees were interviewed.

The purpose of the interviews was to learn the opinion held by the directly involved regarding the problem of supply-maintenance.

c. Orientation Chart for Formulation and Application of the Model

This is another document used to collect antecedents that will allow us to apply the model (Appendix C, Orientation Chart) based on the fixed objectives and the alternatives and strategies developed from the evaluation.

d. Analysis of Documents

The procedure promulgated by the Chief of Staff and Naval Command was used for analysis of documents.

Several of the reference documents are entered in the bibliography.

e. Clustering, Processing and Systemization of the Information

The data obtained in the surveys were manually processed and tabulated. The frequencies were transformed to percentages. The analysis of the nineteen figures that were developed are in Chapter IV and are arranged in a matrix to facilitate examination.

This phase was concluded by developing a prospective model for supply of maintenance materials at the third level. Previously (see Appendix D) a design had been developed in which two segments were elaborated: the operative and the administrative.

4. Contrast

Based on the analysis of the data, interpretations were made that allow us to confront the levels of analysis,

the hypotheses formulated, the information received, support the proposed model theoretically as well as practically.

Conclusions and recommendations provide a model for supply of materials for maintenance to the third level for the Naval Units.

IV. DIAGNOSIS

The process of modernization of the fleet initiated in the seventies presents serious challenges. The search for alternative systems required that they guarantee the efficient and effective operation of all units in the fleet, especially those recently acquired or in the process of being acquired.

This study concludes that at present the system does not exist which can guarantee operation within the accepted limits of reliability, effectiveness and economy during its life cycle. While it is true that in the last few years efforts to resolve the existing problems have been attempted, particularly in the area of maintenance, these have not been directed to permanent problem solving. This is reflected by the lack of a unified operational plan and a scarcity of basic elemental systems such as supply and of human resource development in concert with desired objectives.

A challenge is to determine from where and under what conditions we must operate in order to find effective and reliable systems.

Appendix E is now utilized to support the task of formulating the proposed model.

Another aspect worthy of mention in the diagnostic process is the limitations encountered. While it is true

that the diagnosis, in the strict sense, is an evaluation of the reality to be transformed or changed, it is no less true that every diagnosis implies a value judgment, which could involve somehow judging the company, a totally alien factor to the purpose of this project. It is pertinent to note and remember that the present phenomena are not always self-explanatory.

An analysis of the tendencies encountered in the supply process for the third level was also conducted.

The supply problem was analyzed and given a dimension in order to provide a forecast predicting in the future if the tendencies or observed situations are maintained.

A. RELEVANT SITUATIONS FOUND FROM THE DIAGNOSIS

1. Organization of the Supply System Materials

In previous years the organization functioned by geographical criteria. However, with the development of communications and transportation, especially aviation, the necessity for a structure by geographical orientation has been eliminated.

The organization of a supply system has always been an area of discord centered on how to orient the organization. The conflict is generated by the need to define if the system should be oriented toward:

- the classification of articles managed.
- the equipment or unit supported.

- the geographical area where service is rendered or in accordance with another base of organization.

Presently the question has narrowed to:

- the classification of articles;

- criteria for equipment or units to be supported.

General recognition exists by analysts and administrators that a stratification of need assessments greatly facilitates management's task.

Fourteen questionnaires were completed by executive personnel in answer to the following question: What do you believe would be the best organizational structure for logistical support, as it relates to supply of spare parts?

Of those interviewed, eleven (80%) were favorable to Navy structurization of the organization for supply management based on the criteria "Classification of articles," giving the following advantages:

(a) Grouping of articles of the classification under the responsibility of one administrator facilitates the interchange and substitution of similar articles.

(b) The administrators responsible for inventory as well as the specialists in charge of procurement develop a greater understanding of the specific characteristics in the line of articles they manage.

(c) The capabilities of the local industries are more easily determined with regard to support requirements for military operations.

(d) The providers and contractors are generally specialists in a single line of articles; therefore, the interchange with industry is also simplified. Under this concept less storage space is required.

(e) It is more economical to manage.

(f) Acquisition of large amounts of spare parts are more easily accomplished.

(g) 20 percent (three executives) were in favor of organizing supply functions based on the criteria of equipment or units to be supported. They indicated as advantages:

- Unit commanders would have one contract to resolve supply problems.
- Delivery time for required materials is reduced dramatically.
- A greater affinity among the functions of supply and maintenance is created for the equipment and/or unit supported.

This question was also among those presented to 94 DIANCA personnel, representing 20% of the total of 470 employees and laborers that work in maintenance.

Sixty-two percent of those surveyed were in favor of structural organization based on the criteria "classification of articles" (58) and 38 percent were in agreement of the criteria of equipment or unit of support (36 persons).

It is worthy of mention that both at the executive level and the employee level there is a greater tendency toward the first alternative.

2. Other Relevant Findings

(a) Human resources and technical capabilities of the Navy to effect maintenance to systems and equipment recently purchased were limited and insufficient.

(b) Absence of management information and statistical system from every logistic organization.

(c) Dependency on external, national and international companies. Gradual increments of the dependency are due to the new systems recently purchased.

(d) Difficulty in the management of human resources and the retention of the more qualified individuals.

(e) The lack of a supply system and programmed maintenance procedures.

B. EVALUATION OF THE FINDINGS

There is a diminished capacity to maintain as a result of growth and complexity of equipment to be maintained incorporating new modern and technologically advanced equipment. Sixty percent of maintenance at the third level is being done by local contractors or foreign contractors. It is obvious that this percentage will grow in the near future. The infrastructures of existing maintenance are not appropriate to handle new technology and the investment to bring them up to date would be extremely high.

In the study conducted in 1976 by the Logistical Headquarters, it was determined that maintenance was being

affected in its programming, execution, the supply of spare parts and by the utilization of unqualified personnel.[8]

This situation reflects a lack of coordination between planners and executors. It is also inferred that maintenance is dispersed within the structure of the Navy.

Since the study was made, the situation has not changed. It has been aggravated by the human resources difficulties and the increases in service time of submarine and ships which have begun to require greater maintenance and quantity of spare parts.

The absence of an educational policy in the Navy oriented toward maintenance has brought about the stagnation of personnel once qualification has been reached; an exodus from the service occurs in direct proportion to the inability to remunerate adequately and provide other expected benefits.

With regard to the qualification process as done by DIANCA, the focus is on technological areas according to survey findings (see Chart IV). Forty-seven percent of personnel have completed these courses.

The survey findings confirmed that a large percentage of maintenance is being performed by small and medium size national companies in some cases with experienced personnel previously employed by the Navy.

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[8]Naval Logistical Headquarters Study, No. 000-01-79.

The unavailability of a supply and maintenance program decreases the efficiency in the utilization of human resources and materials in maintenance not only at the third level, but at all levels.

C. DESCRIPTION OF THE QUESTIONNAIRE

A questionnaire was given to 94 or 20% of DIANCA employees for the purpose of gathering information (see Appendix B).

Twenty-three items comprise the questionnaire, of which four are closed, five are intermediate and 14 are open.

Responses to the question were supplemented by information from the following sources to develop the information which is presented in charts I through XIX.

- Venezuelan national budgets, 1977, 1978, 1979.
- Fifth National Plan.
- Research and specialized studies done by:
  - Navy General Headquarters.
  - War College.
- Departmental Manuals, Logistical Supplies and Maintenance Command.
- Budget and Costs Annual Reports, 1976, 1977, 1978.
- Interviews: thirty-three, distributed as follows:
  - Venezuelan Navy:
    - Six officers.
    - Eight non-commissioned officers.
    - Ten civilians.

- DIANCA:
  - President
  - Administrative Manager
  - Plant Manager
  - Industrial Relations Manager
  - Training Division Chief
  - Purchasing Division Chief
  - Supply Manager
  - Caracas Purchasing Manager

D. SURVEY ANALYSIS AND STATISTICAL CHARTS

Personnel assigned to supply and maintenance at DIANCA totals 470 employees. Twenty percent of these employees (94) were questioned.

1. Personal Data

CHART I

PERSONAL DATA

MARITAL STATUS	FREQUENCY	PERCENT OF TOTAL
Single	34	36%
Married	38	41
Widowed	02	02
Divorced	09	10
Separated	05	05
Cohabiting	06	06
	94	100%

Chart I clearly infers that the majority of personnel working at DIANCA are married (41 percent) followed by single personnel (36 percent).

2. Education

CHART II

EDUCATION

EDUCATION	FREQUENCY	PERCENT OF TOTAL
Elementary	30	32%
Secondary	23	24
College	13	14
Technical Schools	13	14
Other	01	01
No Response	14	15
	94	100%

Personnel with college or technical training comprise only 14 percent each. A greater number of technically trained personnel are needed since DIANCA functions are highly technical.

3. Length of Employment

CHART III

LENGTH OF EMPLOYMENT

YEARS	FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENT
01	10	11%	11%
02	20	22	33

03	27	29	62
04	22	23	85
10	05	05	90
15	03	03	93
21	01	01	94
26	01	01	95
No Response	05	05	100
	94	100%	

Chart III indicates that 85% of those surveyed have been employed by DIANCA from one to four years. This supports the statement that, due to better remuneration and working conditions, there is a continual exodus to other companies and the turnover value is excessive.

4. Specialization

CHART IV

SPECIALIZATION

	HAVE TAKEN COURSES	PERCENT
Yes	44	47
No	50	53
Total	94	100

(a) Specialty Courses that Have Been Completed

- Business Management
- Personnel Administration

- Labor Relations
- IBM
- Labor Analyst I
- Planning and Control - PERT - CPM
- Programming
- Maintenance Electrician III*
- Applied Administration
- Industrial Security III
- Naval Mechanics II*
- Naval Drafting*
- Firemen
- Propulsion Systems II*
- Naval Technology*
- Turbines II*
- Welding*
- Administration and Control of Supplies I*

* Courses critical to maintenance at DIANCA.

When only 47% of the employees have taken specialized courses and Chart III indicates an already existing lack of technical training, a serious weakness is shown. All personnel should be encouraged to take added training.

5. Application of Knowledge to Work

CHART V

APPLICATION OF KNOWLEDGE TO WORK

KNOWLEDGE	FREQUENCY	PERCENT OF TOTAL
Applied	41	93
Not Applied	03	07
Total	44	100

A large percent of personnel apply their knowledge to their work; however, we must make note of the fact that only 47 percent have taken specialized training courses.

6. DIANCA Functional Structure

CHART VI

KNOWLEDGE OF THE FUNCTIONS OF SPARE PARTS/SUPPLY STOCK

FUNCTION OF SUPPLY STOCK	FREQUENCY	PERCENT OF TOTAL
Aware	3	3
Unaware	61	65
No Response	30	32
Total	94	100

7. Stock Availability in Relation to Need

CHART VI

STOCK AVAILABLE IN RELATION TO NEED

SPARE PARTS STOCK	FREQUENCY	PERCENT OF TOTAL
Meets the Need	42	45
Does Not Meet the Need	21	22

No Response	31	33
Total	94	100

Chart VII deals with the coordination of available stock of spare parts in relation to actual needs. Twenty-two percent of personnel surveyed stated parts did not meet the needs and 33 percent did not respond.

8. Why the Navy Utilizes DIANCA for Maintenance and Repair of its Units

CHART VIII

WHY THE NAVY UTILIZES DIANCA FOR MAINTENANCE AND REPAIR OF ITS UNITS

REASONS	FREQUENCY	PERCENT OF TOTAL
Because it is the only one available	70	75
Because it is the closest to the principal base	24	25
Total	94	100

Seventy-five percent of personnel surveyed feel DIANCA is used because it is the only dry dock in the country, and twenty-five percent assume it is because DIANCA is closest to the main Naval Base.

One can infer that both answers are erroneous in spite of the fact that they are logical. The fact is an agreement exists between DIANCA and the Venezuelan Navy.

Questions 2.1.4 and 2.1.5, Appendix B, had 100 percent response to DIANCA's repair of all units and that this company gave preference to the Navy with regard to maintenance work.

9. Importance of Levels of Maintenance

CHART IX

IMPORTANCE OF LEVELS OF MAINTENANCE

MOST IMPORTANT MAINTENANCE	FREQUENCY	PERCENT OF TOTAL
That carried out by the crews (first level)	58	62
First and second level	22	23
All	12	13
Did not respond	02	02
Total	94	100

Chart IX refers to maintenance. After analysis one reaches the conclusion that the most important level of maintenance is carried out by the crew on board, being that which prevents future deterioration. Sixty-two percent answered affirmatively, 23 percent gave importance to the first and second levels. In summary, one can infer that the first two levels account for 85 percent of the opinion.

10. Causes that Occur with Greatest Frequency in Repairs

CHART X

CAUSES THAT OCCUR WITH GREATEST FREQUENCY IN REPAIRS

CAUSES	FREQUENCY	PERCENT OF TOTAL
Maintenance not done at the first level.	76	81
Lack of equipment to test what has been repaired	15	16
Total	94	100

Chart X refers to the causes that occur with greatest frequency in repairs. The principal cause is not doing maintenance at the first level, as seen in the chart. Eighty-one percent responded that normally it is not done.

11. Causes for Delay in Maintenance at the Third Level

CHART XI

CAUSES FOR DELAY IN MAINTENANCE AT THE THIRD LEVEL

CAUSES	FREQUENCY	PERCENT OF TOTAL
Lack of sufficient technical specialists	55	59
Lack of stock of required spare parts for repairs	22	23
Lack of specialized personnel & spare parts	17	18
Total	94	100

Chart XI refers to the causes for delay in maintenance at the third level after analysis. Fifty-nine percent responded that there is a lack of specialized technicians and 23 percent referred to the lack of spare parts for stock required for repairs.

12. Budget and Costs

CHART XII

BUDGET AND COSTS

INTERVENE	FREQUENCY	PERCENT OF TOTAL
Personnel attached to administration	63	67
Division chiefs	31	33

THOSE WHO INTERVENE IN THE PREPARATION OF BUDGET.

Chart XII explains that only 67 percent of administrative personnel intervene in the preparation of budgets which necessitate participation by division chiefs in order to present a more accurate budget rendition.

13. Source of DIANCA Budget

CHART XIII

SOURCE OF DIANCA BUDGET

SECTOR	FREQUENCY	PERCENT OF TOTAL
Public	55	59
Mixed	24	26
Private	05	05

Did not respond	10	10
Total	94	100

Chart XIII, concerning the origin of the DIANCA budget reflects the lack of knowledge of those interviewed. Fifty-eight percent believe the DIANCA budget originates from the public sector. Twenty-six percent believe it is a mixed budget and five percent believe it originates from the private sector. In accordance to the answers to question 3.1.3 in Appendix B, "Does the programmed budget cover the requirements to effect maintenance up to the third level?" one hundred percent of those surveyed responded that the allocated budget covers the requirements to effect maintenance and repair.

14. Controls Employed by the Government Accounting Office, with Reference to the DIANCA Budget

CHART XIV

CONTROLS EMPLOYED BY THE GOVERNMENT ACCOUNTING OFFICE WITH REFERENCE TO THE DIANCA BUDGET

TYPES OF CONTROL	FREQUENCY	PERCENT OF TOTAL
Checks on normalization of standards in prices and labor	45	48
Unknown	24	25
Did not respond	25	27
Totals	94	100

Chart XIV refers to the types of controls that the government accounting office employs with reference to the DIANCA budget. Forty-eight percent responded that controls should be exercised with regard to normalization of standards in prices and labor, twenty-five percent are unaware and twenty-seven percent did not respond.

15. How Controls Are Effected over Spare Parts Stock at DIANCA

CHART XV

HOW CONTROLS ARE EFFECTED OVER SPARE PARTS STOCK AT DIANCA

CONTROLS	FREQUENCY	PERCENT OF TOTAL
By maximum and minimum of replacement standard	44	47
By kardex available at warehouses	26	28
Controls are being created as they do not exist	24	25
Totals	94	100

The greatest percentage, 47 percent, responded that controls of spare parts should be done by maximum and minimum replacement standards.

16. Which Are the Deficiencies in Stock of Spare Parts

CHART XVI

WHICH ARE THE DEFICIENCIES IN STOCK OF SPARE PARTS

CAUSES OF DEFICIENCIES	FREQUENCY	PERCENT OF TOTAL
Unawareness of spare parts in stock	21	22
Existence of old materials	50	53
The majority of existing stock is not used	24	25
Totals	94	100

Chart XVI explains this question. Upon analysis one finds that 53 percent responded that there is an excess of old stock, 25 percent affirms that the deficiency is constituted by the fact that existing parts are not used and 22 percent responded that the cause is lack of knowledge of spare parts in stock. If Chart XV is correlated with this chart, one sees that the lack of knowledge and the lack of controls coincide.

17. Criteria for Overcoming Deficiencies Observed in Existing Spare Parts Stock

CHART XVII

CRITERIA FOR OVERCOMING DEFICIENCIES OBSERVED IN EXISTING SPARE PARTS STOCK

CRITERIA	FREQUENCY	PERCENT OF TOTAL
Eliminate unnecessary spare parts and retain those used frequently	66	70
Obtain usable spare parts	28	30
Totals	94	100

Chart XVII deals with criteria to overcome deficiencies in existing stock of spare parts. Seventy percent recommended unnecessary spare parts should be eliminated and 30 percent suggested that usable spare parts must be obtained.

18. Suggestions for Storage of Spare Parts

CHART XVIII

SUGGESTIONS FOR STORAGE OF SPARE PARTS

SUGGESTIONS	FREQUENCY	PERCENT OF TOTAL
By equipment	59	62
By category	35	38
Totals	94	100

Chart XVIII reflects suggestions for storage of spare parts. Sixty-two percent of those surveyed believe storage should be done by equipment and 38 percent by category.

19. Rating of Technical Administrators that Work at DIANCA

CHART XIX

RATING OF TECHNICAL ADMINISTRATORS
THAT WORK AT DIANCA

RATING	FREQUENCY	PERCENT OF TOTAL
Excellent	03	03
Very good	61	65
Good	28	30
Did not respond	02	02
Totals	94	100

The greatest percentage was found within the parameter, "very good."

VI. A PROSPECTIVE MODEL FOR SUPPLY OF MATERIALS FOR MAINTENANCE AT THE THIRD LEVEL

A. OPERATIONAL CAPACITY

A submarine built in Germany will be used as the sample unit for this model. This unit is used since it is one of the most complete and representative of the fleet.

1. Description of the Submarine

In general terms it is a unit which is able to travel under the surface. It is equipped with snorkels, a tube that by taking air from the surface allows continual immersion.

The snorkel forces the submarine to navigate near the surface, precluding great speed. This situation has been improved with the nuclear submarine. (They have large radii of action and are ocean going.) Their tonnage varies from 650 to 2,000 or more. The nuclear submarine is that which can navigate permanently submerged until its source of energy is exhausted. It can also choose its depth to the maximum resistance of its structure.

A nuclear submarine can remain submerged for months and as long a period of time as required by the missions.

The nuclear submarine develops speeds that are much greater, having a greater advantage over surface ships even though they may be of nuclear propulsion.

2. Comparison between the Submarine and Surface Ships

Some officers feel the Naval Industry should concentrate its efforts on the submarines, restricting in part the construction of surface ships.

Officers of surface ships are subject to the effects of submarine attacks as well as aerial attacks which are of greater range; ships that are on the surface at the time of an explosion are vulnerable to it.

There are those who claim that the greatest probability for survival at the time of a naval attack is found within the submarines. This security increases when the submarine is submerged since thermonuclear bomb action is virtually nullified.

This superiority has been relative; on the one hand the submarine was usable to establish its superiority (in World War II), and on the other hand the times it has been defeated by the masses of the enemy more so than for its overpowering qualitative superiority. The principal disadvantage of the submarine resided in the requirement of using, while submerged, electrical motors powered by a battery of accumulators that were heavy and cumbersome. This source of energy was rapidly depleted and it had to be recharged by thermal motors on the surface.

The supporters of the integral submarine, who are very radical, go as far as to state that repairs of this type should be done under submersion.

The underwater repair facility would offer guarantees, but its realization is difficult. To begin with, its own nature would limit the tonnage of submarines. Also, it should be mobile; if it were fixed the enemy could detect it, attack it and destroy it with thermonuclear bombs of submarine use, fired with precision.

The description of the submarine made as well as the comparison with surface ships, we will now develop the model in its two branches, Operational and Administrative, and will develop the steps related to the Operational functions.

3. Aspects of Supply

Two years prior to the submarines entering DIANCA for maintenance, the Division Chiefs must conduct a thorough study of spare parts required considering: records of equipment, reports of failures, manuals and lists of spare parts.

By making a detailed analysis of those whose use is considered for a five-year life span, determination is made of those that will not be required for maintenance at the third level.

In this model we have chosen a piece of equipment from each division:

a. From operations, the plotting table.

b. From Engineering, a gyroscope.

c. From Armaments, torpedo tubes.

d. From Logistics, no equipment was selected because their spare parts are easily obtained.

The Division Armament, in our example, provided a list of spare parts to repair the torpedo launch tubes, totaling 1,591 parts.

This is the total, buying a spare part for each one. This requires purging of maintenance manuals and the application of technical criteria to parts.

Once done, the list is sent to the logistics Division Chief of the submarine who verifies their availability in warehouses and takes them from the armament list. The existing supply showed 430 spare parts, 1,161 to be obtained by needs expressed in the initial list.

The Operations Division Chief is to repair equipment, the plotting table. This piece of equipment required 275 spare parts, of which upon logistical revision in warehouses, 30 parts are in existence, and 245 lacking from the initial list.

From the Engineering Division, the gyroscope was taken as an example. The Division Chief, after revision of manuals, records and failure reports that the required spare parts numbered 254. This list was verified by logistics with existent stock in the warehouses locating 11 parts and requiring an additional 243.

The three lists were sent to the Naval Material Command (Headquarters). They were reviewed by the Divisions of Armament, Engineering and Communications. After review, these lists were forwarded to the Supply Division (DIMA). The Supply Division sent these lists to the supply section at Rear Admiral Agustin Armario Naval Base in Puerto Cabello, where it was established if the required spare parts were on hand in the warehouses.

Once the lists were reviewed it was established that in Operations there were 178 in stock and 67 lacking. In Engineering there were 212 in existence, and 21 lacking. In Armament there were 102 parts available and a total of 1059 parts lacking.

After an analysis on the existing spare parts in on-board submarine supply rooms and in the Supply Section at the Rear Admiral Agustin Armario Naval Base, and the subsequent reduction from the initial list, it was determined that purchases of spare parts in Venezuela or from abroad were necessary:

a. Operations - 67 spare parts.

b. Engineering - 31 spare parts.

c. Armaments - 1059 spare parts.

To effect maintenance and repair up to the third level on the plotting table, the following are necessary:

a. Check the correct functioning of the switches.

b. Check the projection of the cobweb.

c. Check the speed and direction and scale of the plotting table.

d. Remove the upper part of the plotting table structure and verify the installation.

e. Charge and give appropriate tension to the roller after cleansing and lubricating.

To effect maintenance and repair up to the third level on the gyroscope, the following steps are required.

- Check the emergency batteries.
- Clean the sphere.
- Check the gyroscope motor.
- Check gyroscope support housing.
- Verify the generator motor.
- Check the amplifier valves.
- Renovate the support lubrication.
- Effect an overhaul of the gyroscop's equipment.
- Check the automatic pilot function.
- List the amplifier.
- List the oil pressure.
- Dismount and remount the periscope.
- Disassemble and repair the periscope.

To effect repair and maintenance up to the third level on the torpedo tube, the following guidelines apply:

- Torpedo hydraulic system. Every four years the following requirements must be met:

. Check and calibrate the pressure reductor.

. Check the correct functioning of the following hydraulic systems, disassemble them and make repairs, if necessary:

.. Mechanism for maneuvering the torpedos.

.. Mechanism for the second phase of the whip antenna.

.. Capstan mechanism.

- Compressed Air System.

. Change the expansion joints.

. Repair/change, if necessary, the reductor valves.

. Check the siren system.

. Check and repair security valves.

. Disassemble and repair the purge air.

. Complete an interior inspection of the hull and effect pressure checks.

. Change magnetic valves.

. Inspect the interior of the oxygen tanks and the manifolds and effect pressure checks.

. Disassemble, clean and repair, when required, the reduction valves.

- Check the compressor: Dismount, disassemble and clean the air conditioners.

. Test pressure on air conditioners.

. Test pressure on copper tubing.

. Change security valves in the air conditioners.

.. Lubrication pump.

.. Gear box.

.. Check cylinder lends.

.. Change casings.

.. Change pistons.

.. Change connecting rods.

.. Disassemble crankshaft.

.. Check bearings.

.. Disassemble and check the separators.

.. Disassemble compression pump.

.. Test compressor's capacity.

. Check and repair the evaporator.

. Check and repair the compressor motor.

. Check instruments for precision in readings.

- Purging of the System.

. Check to ensure air compressor's openings are functioning.

. Change, as needed, parts required.

. Check the system's operation.

. Repair, if required, connections, valves and supports.

. Check the torpedo launcher computer.

. Check the insulation.

. Check nozzles.

.. Check connecting cable on the torpedo.

.. Test watertightness of the socket in the torpedo tube.

.. Check tubing and connections of the hydraulic system.

.. Check and repair if necessary the transport mechanism.

.. Test function with torpedo tube loading tackle.

.. Inspect torpedo motor and transmission.

.. Check and repair, if necessary, the loading and unloading platform.

.. Change component parts, such as zinc anodes.

.. Repair zinc anodes, if necessary.

.. Verify the movements of special implements.

The Supply Section sent the lists to the Supply Division (DIMA) at Naval Material Command and these lists were put on the market.

In our case, none of the commercial establishments wished to make quotes on spare parts costs due to inflation within the country and abroad.

In Venezuela there is only one business that can provide quotes, Howatts Deutschs Werft, who makes delivery on spare parts one year after receiving the letter of credit that ensures payment on delivery of goods.

In our case, the lists were given to this supply house to obtain quotes and the same lists were sent to DIMA in Italy, which functions as the central purchasing agent for spare parts in Europe. A direct transaction with the manufacturer was attempted.

It is known that supply houses that can provide the mentioned spare parts exist in France, Italy, Germany, England, and the United States that have connections with

DIMA for the purchase of spare parts. The focal point throughout this thesis is to attempt to eliminate intermediaries, since it is known that they charge a 30 percent commission and require a letter of credit from national or international banks ensuring payments.

Once the quotes are received from the Venezuelan commercial supply house, and the European H/D/W quotes are studied, the best offer is sent to the General Accounting Office for approval. Once approval is given, the General Accounting Office produces the letter of credit which allows purchase of the required parts.

In this model, the quotes are not submitted to DIANCA, since the standard spare parts list is not included. It is in the process of being designed so that it could be utilized mid-year in accordance with the available programming for meeting the deadline. This was detected in the diagnosis.

The Supply Division of the Venezuelan Navy Headquarters receives spare parts from the importing company and sends them to the warehouses in Puerto Cabello. Upon entering dry dock for maintenance and repair up to the third level, the mentioned spare parts are used to solve the supply problem for the different submarine equipment.

In the plan we will now present, one can see the dynamics of materials supply. In the Diagnostic Step it

was determined that DIANCA has a contract with Motor and Turbinen Union (MTU) of Germany to effect maintenance and repair of submarines, the frigates and the patrol boats. Spare parts for the MTU motors must be obtained through the Purchasing Division, with DIANCA charging a reasonable percentage of 15% over the cost of the spare parts for serving as intermediaries.

B. CONSIDERATIONS FOR ESTABLISHING THE MODEL

Before detailing the administrative scope of the project we will present the following considerations regarding the Philosophy of Logistical Support. (See Appendix K.)

C. THE ADMINISTRATIVE SCOPE OF THE PROJECT

Consider the basic premise that the administrative integrates total indivisible coordination and harmony. To attempt to divide them or fragment these is impossible because in the course of a project, its parts or units complement, mutually complementing one another.

According to Francisco Blanco Llesca, administration is the process by which the group proposes to attain certain goals, with a minimum of effort and in the least possible time.[9]

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[9]Francisco Blanco Llesca, "El control integrado de gestion," Editorial Quintana Madrid. March 1975.

The administrative scope of this project, which incidentally is a prospective model, can be divided into two well differentiated movements, entitled pre-executive and executive stages.

The first stage is comprised of: foresight to be considered in the Navy, such as organic Law of the Armed Forces, administrative system of the Navy, etc. (specifically in C and B), that which can be realized in the preparation of a project of any nature. The second stage is dedicated to the execution of the actions that have been selected.

The pre-executive stage separates certain phases that allowed us to obtain a better understanding of the realities regarding maintenance to the third level. Another phase of this stage was the determination of objectives. During the third phase, activities were programmed, finally organizing the functions and persons that will execute the project.

In the executive stage, functions would be delegated, programmed activities would be coordinated, the process of supply would be followed and the results evaluated.

Both phases follow a logical order within themselves. In this same manner, we feel that the different phases will also be developed following the examples mentioned. However, in our model, in accordance to what the practice has demonstrated, the administrative process is developed by chronologically passing through each one of the phases and stages. Generally, this order must be altered to return

to a previous phase, correct a previous process and again develop it. This methodology will be called "iterative."

For this reason, we have graphically represented the process of administrative reach with a circular figure that demonstrates how the last part of an activity in our project can be the first phase of a new process. (See graph II, Appendix H, and orientation chart, Appendix E.)

The figure shows the logical order between the stages and the phase of this sequence. This order has been deduced to the great administrative functions that assist us in characterizing, identifying and placing in order the multiple actions that make up each one of its phases.

Until recently, administrators coincided that the administrative process encompasses the basic functions of planning, organization, execution and control. This sequential image is changing for a more flexible and adequate concept to the problems it must solve.

In the process, the functions do not disappear. Instead they are constituted in ordering elements of the phases that integrate each stage, and on the other hand, allow analysis and a better understanding of the inner workings that unite the entire process. In our model, the administrative functions are designed to set in order the multiple activities that correspond to each one of the stages. (See Appendices H and I.)

D. ADMINISTRATIVE REACH

ANTECEDENTS: With the new acquisitions of units by the Navy in the 70's in the process of fleet modernization, informational needs have surfaced which the existing logistical system has not been able to support due to the great variety and volume of data required for decisionmaking in the administration of said units.

It is well to clarify that any modern Navy has similar problems that have been alleviated to a greater or lesser degree.

1. Naval Headquarters Staff

Naval Headquarters is the organization charged with advising the Navy General Headquarters. This advice is related to planning of operational and administrative functions with the goal of establishing policies and decisions.

To fulfill its mission Naval Headquarters staff is constituted by:

- Headquarters
  - . Office of the Adjutant
  - . Secretariat
- First Division (Naval Personnel Division)
  - . Headquarters
  - . Department of strategies
  - . Department of counter intelligence planning

. Safety Department

. Electronic warfare

- Third Division (Naval Operations Division)

. Headquarters

. Operations department

. Preparation of Operation Plans Department

. Preparation of Operational Training Schedules

- Fourth Division (Naval Supply Division)

. Headquarters

. Secretariat

. Logistic Plans Department

. Economics, Programming and Budget Plans Department

The primary idea of this project consists in elaborating a model that has as its input:

- Naval material resources.
- Financial resources.
- Personnel.
- Advisory organism to Chief of Naval Operations.
- Navy.

This gives us three Naval operative units, submarines to which maintenance to the third level will be done.

2. Administrative Model

a. Definition

It is the joining of parameters and policies in which man can conduct himself, combining them on the administrative axioms.

b. Hypothesis

The Navy will train its personnel for the different levels of maintenance, will provide material and financial resources with the aim to provide maintenance to the third level to three submarines within a predetermined time period.

Since the administrative reach refers to planning of operative and administrative functions, we must take as a starting point the following axioms of this project.

(1) Elaboration of a List of Priorities

This phase, in our model, corresponds and is described in the area of operative reach, including specific tasks to each one of them.

The Maintenance Division must review, change and renovate all the mechanisms (artifacts, equipment, replacement implements, etc.) that are not in good working condition.

Once all the specific tasks are obtained for each one of the submarines, different priorities must be assigned based on the following objectives:

Due to the great quantity of activities that are to be attained in the development of this project to obtain an accordant system of supply, priorities are assigned according to the needs of the following functions:

- Inventory control.
- Acquisition.
- Storage.
- Cataloging.
- Accounting of material.
- Distribution.
- Delivery and return.
- Elimination.
- Transportation.

(a) Inventory Control

The following activities are assigned as priorities in the development and implementation of inventory control.

NUMBER	DESCRIPTION	PRECEDENT
1	IDENTIFICATION OF THE COMPLEMENT LISTS Definition of the L.R.U. (modules) necessary to effect maintenance at the 1st and 2nd level of spare parts at level of components and points necessary for maintenance at the third level. The L.R.U. will be identified and codified. Designs will be elaborated that form the data base. Programs to generate complement lists will be developed by unit. Manuals	

of norms will be created and procedures to elaborate and maintain complement lists on-board and on-shore.

2 INITIAL INVENTORY

Obtain initial lading of data that will form the data bank.

Programs for same will be developed.

Data will be transcribed by means of terminals located at Supply Headquarters (BNAR) and cofification Department (DIMACM).

3 IDENTIFICATION OF SUPPLIERS

Identify and codify suppliers to provide materials to the Navy.

Elaborate analysis of the systems for identification of suppliers.

Elaborate programs for lading and identification of suppliers of materials for the Navy.

Elaborate manuals of suppliers.

4 PHYSICAL PERMANENT INVENTORY

Create manual to elaborate physical permanent inventory.

Elaboration of analyses and programs for actualization of physical inventory.

5	LISTS OF INTEGRAL COMPLEMENTS	1
	Create manuals of norms and procedures foe elaboration and structuration of the integral complements lists of spare parts. Elaboration of analysis and programs for the integration of first level parts by manufacturer and level and inter-company level. Purging of errors from integral complements lists for spare parts.	
6	CONSUMPTION STATISTICS-FINANCIAL AND UNFILLED ORDERS	
	Elaboration of manuals of norms and procedures for elaboration and utilization of financial consumption statistics and unfilled orders. Elaboration of analyses and programs for financial consumption statistics and unfilled orders.	
7	INTERNAL REQUISITIONS (ON BOARD)	
	Elaborate norms and procedures for on-board requisitions. Elaboration of analyses and programming for requisition controls and efficiency of on-board replacements.	

8	EXTERNAL REQUISITION Create norms and procedures for external requisition to obtain efficient communication between ship-supply for receipt of material. Elaborate analyses and programs for external requisition contracts.	5-7
9	CATALOGING OF USERS Create manual of norms and procedures for users to follow in obtaining spare parts. Identify and codify users of naval spare parts. Obtain analyses and programs for cataloging of users.	1
10	ATTAINMENT BY PURCHASE-TRANSFERENCE BY DEFECT-DONATION Create manuals of norms and procedures attainment by purchase and transference by defect-donation. Elaborate analyses and programs for same.	3-7-8
11	SEPARATION CONTROL Create norms and procedures that allow separation controls for spare parts.	10

Elaborate analyses and programs for spare parts separation.

Purge space being used in warehouses for stock of unsuitable or no longer used parts.

12 PREDICTIVE MODEL

Define predictive model based on the execution-ability and acceptability of Naval Operations.

Create policies for calculation of maximum-minimum and orders as well as amounts to be ordered.

Elaborate analyses and programs for calculation of levels.

(b) Have operative units for navigation.

(c) Have armaments operational.

(3) Organic Law of the Armed Forces

(a) Organic law typifies that Naval Headquarters Staff is who provides the best alternatives without making decisions.

(b) Organic Law establishes the essential requirements so that personnel can scale the different grades or hierarchies, as well as the necessary courses for getting along in these.

(c) Organic law speaks of the existence of Joint Chiefs of Staff, which is the advisor to the

Department of Defense for acquisition of spare parts for units at the adequate location (abroad).

(d) Organic law establishes that Naval Headquarters Staff must provide the Chief of Naval Operations with the necessary judgment elements for better decisionmaking.

(4) Administrative System

The Logistics Headquarters at Puerto Cabello exists to repair units up to the second level. DIANCA facilities are also found there to effect maintenance and repair to the third level.

Spare parts will be acquired by the Supply Division and stored in the warehouses at Agustin Armario Naval Base.

The Maintenance Department at Puerto Cabello Naval Base can authorize isolated repairs for any unit, as required.

Naval Material Command (Headquarters), via the supply division of Naval Headquarters, possesses resources to buy spare parts and send them to the Department of the Naval Base to facilitate maintenance and repair of the units of the fleet to be effected at DIANCA. The administration of each one of the submarines possesses budgetary allowances for the acquisition of resources of low monetary value to alleviate the anomalies of the different on-board departments.

(5) Qualification of Personnel

The principal idea consists in having, in each unit, the required personnel to efficiently operate at sea for a five-year period.

Qualification will be approached by optimization and development of operative levels of the units in each one of the different levels.

To that effect a detection plan for operative needs regarding qualification will be developed taking into account the different priorities. A parallel plan should be developed to ensure application of the knowledge gained.

Soliciting intervention by the Naval Education and Training Command is considered a viable recommendation for the positive functioning of the qualification process.

Persons having responsibility of the different equipment in the Naval Units should have minimum qualifications so that units can be operated rationally and reasonably.

The crews of the different units should know how to effect maintenance at the first level (preventive and on-board repairs with on-board tools and personnel).

Personnel at shops on land must know how to effect second level (equipment and personnel on-shore and on-board) and third level (on-shore) maintenance.

Finally in the qualification process one must elaborate, in an integrated manner with the Unit Commanders and the Naval Education, a follow-up system and periodic evaluation that will prove that the knowledge acquired in the qualification centers is put into practice in a real and effective manner.

In this project we must also take into consideration the following aspects regarding qualification:

(a) Personnel

The Naval Personnel Command selects suitable personnel for each task, its principal task being that of placing the right man in the right job. This division furnishes officers, non-commissioned officers, sailors, marines and civilians to integrate the requirements of the Navy.

It is worthy of mention that to meet these requirements the Naval Personnel Command considers each one's specialty and additionally takes special care to ensure that personnel develops efficiently in their assigned posts through verifications by the Inspector of the Navy and the fleet.

To fulfill its mission, the Naval Personnel Command is comprised of:

Headquarters

- Office of the Adjutant
- Secretariat

Military Personnel Department

Civilian Personnel Department

Health Department

Justice Department

Welfare Department

(b) Education and Qualification

The Naval Education and Training Command is the responsible organization to form, instruct, train and manage Navy human resources with the goal of providing personnel with the quantity and quality of knowledge to take care of the Navy's needs.

To fulfill its mission, the Naval Education and Training Command is comprised of:

Headquarters

- Office of the Adjutant
- Secretariat
- Superior Council of Naval Education
- Post-Graduate School
- Naval School (College)
- Instruction Department
- Naval Training Center
- Marine Training Center

(c) Financial Resources

Venezuelan Navy Headquarters in its planning for the attainment of these objectives, possesses

approved financial resources which will be assigned to:

- Ensuring that the Naval Material Command (Headquarters) can function without financial problems and successfully effect maintenance and repair the three submarines.

- Provide resources for purchasing spare parts abroad so that maintenance can be effected.

- Provide necessary resources to contract personnel to have adequate levels of trained personnel for repair.

- Provide resources for contracting specialized personnel from abroad if required, for review and repair of the submarines.

- Provide resources to pay overtime, should the need be established.

(d) Material Resources

Systematically supply to the naval material user (spare parts, accessories and equipment) what they may require in appropriate quantities and quality at the opportune time, the indicated location and in the most economic manner. This is the principal and permanent objective of the Venezuelan Naval Material Command. To meet this objective, the logistics Headquarters is comprised of:

Headquarters

- Office of the Adjutant

- Secretariat

Naval Bases

Supply Department

Engineering Department

Armaments Department

Naval Stations

Naval Missions Abroad

It is well to note that the Naval Materials Command also has the support of the Logistics branch of the Department of Defense, since it has resources to acquire spare parts for units in Venezuela and abroad.

V. CONCLUSION AND RECOMMENDATIONS

The following conclusions and recommendations have been reached upon revision of the fundamental theoretical concepts, the operative portion of what is being done and what should be done regarding maintenance, repair and supply of materials for Naval Units to the third level.

We have considered, in the interest of order and systematization, to deal first with general conclusion and later specify others as participating factors in the Supply and Maintenance process.

Our propositions regarding conclusions and recommendations are strongly intended to satisfy, on the short and long term, the requirements of supply of spare parts for maintenance of units to the third level with the goal of contributing to reaching a high degree of operational optimization.

A. GENERAL CONCLUSIONS

1. The Venezuelan Navy is not now prepared to properly effect maintenance on armament systems for the following reasons:
   a. Technical and human resources are limited.
   b. There is no general and statistical information system in the entire logistical organization.
   c. The system depends on foreign and national companies.

d. There are difficulties in the administration of human resources, particularly regarding retention and performance.

e. The lack of a supply system and programmed maintenance.

2. Great complexity exists in the distribution, manipulation and synthesis of data for decision-making. These data are presently being processed by manual systems, with consequent lack of control in the supply system. The following conditions exist:

a. No communication system exists between bases and warehouses regarding information, planning and programming.

b. The Supply Division does not have an up-to-date control system for purchase, storage, control and distribution of goods and materials that can provide the Naval Materials Command with judgment elements and necessary data on administration of Naval Supplies so that it may base its decisions on reality.

c. The Supply Division does not maintain coordination with all dependencies of the Navy with relation to purchase and supply.

3. The Venezuelan Navy does not have an efficient and effective supply management system for control of spare parts.
4. There is a gradually increasing dependency on local and foreign companies as a result of new systems recently acquired.

B. CONCLUSIONS PERTAINING TO PERSONNEL

1. Technical personnel are not adequately qualified.
2. There is the lack of a policy for training in technical areas in the Navy as well as at DIANCA.
3. Personnel charged with the responsibility for the different equipment in Naval units must have the minimum required training so that these can be operated in a rational and responsible manner.
4. The crews of the different units of the fleet should know how to perform maintenance at the first level (preventive and on-board repairs, with on-board tools and personnel).
5. Personnel at on-shore facilities should know how to perform maintenance at the second level (equipment and on-shore as well as on-board personnel) and the third level (at on-shore facilities).
6. Personnel qualification influences the efficiency of maintenance and repair to Naval Units up to the third level.

7. The preparation of a list of priorities (in training for maintenance capabilities, etc.) is essential for adequate selection of personnel.
8. There are difficulties in the administration of human resources (with regard to concentration and retention as well as their performance within their limited technical know-how).
9. There is limited technical qualification of human resources in the Navy to effect maintenance for systems and equipment recently obtained.
10. A lack of coordination between planners and executors exists.

C. CONCLUSIONS: DETERMINATION OF NEEDS

The determination of needs is of vital importance to guarantee the future operation of weapons systems. If it is not well done, the results are disastrous in the use of the weapon.

The determination of needs process is a theoretically simple concept; however, the practical solution is an arduous task that is time-consuming and demanding on human resources and materials. The determination of needs requires the use of scientific analysis techniques, which must be done by personnel with expertise in the field.

D. CONCLUSIONS: ORGANIZATION OF THE MATERIALS SUPPLY SYSTEM

1. Administration by article, equipment and/or system to be supported must be the orientation given to the system.
2. There is no adequate stock of spare parts to satisfy all the requirements of equipment, since all spare parts for on-board use bought for one year must have been used and on-shore spare parts must be at 60 percent. Nonetheless, these spare parts were not chosen under a scientific criteria of having a replacement in case of failures.
3. The Chief of the project model and the person in charge of purchases must provide, at the time of inventory control, the following information:
   a. Programming for production and delivery of equipment and/or systems.
   b. The maintenance plan.
   c. The description of equipment.
   d. The operational requirement.
   e. The expected use of equipment.
   f. The number and type of required maintenance installations.
   g. Any other information of importance to planning for logistical support for equipment that has entered into operation.

4. The warehouses do not keep permanent inventories that will guarantee supply to the units and dependencies of the Navy.
5. The present supply system lacks up-to-date information on processing purchase orders for spare parts and equipment in process of acquisition from the time the purchase order is issued to the time parts are received at warehouses.
6. The present system does not have a statistical record for consumption and finances that can be used in decisionmaking.
7. Information regarding interchangeability and substitution of parts is not available.
8. Computation of maximum and minimum levels, orders and the amounts required are not done.
9. Only 30 percent of spare parts, components and equipment that integrate the different Units of the Navy have been identified (codified).
   a. 18,000 parts of the frigates of Mariscal Sucre type.
   b. 16,000 spare parts for patrol boats.
   c. 21,000 spare parts for submarines.

E. CONCLUSIONS: MAINTENANCE

1. There is no adequate infrastructure nor logistical support to handle maintenance activity.

2. There is a lack of tools and instrumentation to carry out technical activities that contemplate all maintenance.
3. The systematic analysis process with regard to maintenance at the third level is dynamic and interactive; therefore, the results of one (first and second level) modifies the bases of the others in such a way that it must have an iterative character.
4. As a consequence, there is no capability to perform maintenance to units presently in operation, and it is evident that future maintenance will present the same problem based on the technical sophistication that will characterize new units.

F. RECOMMENDATIONS

1. Personnel

a. The professional team, designated for materials supply for maintenance to the third level, must be comprised of supply and material technical personnel of Naval Units.

b. Carry out the necessary actions to create an adequate climate, provide incentives, and train personnel responsible for supply and maintenance for otpimization of services.

AD-A123 799 PROSPECTIVE MODEL AND ITS METHODOLOGY OF SUPPLIES FOR THE REPAIR AND MAIN..(U) NAVAL POSTGRADUATE SCHOOL MONTEREY CA J B VIVAS JUN 82 2/2

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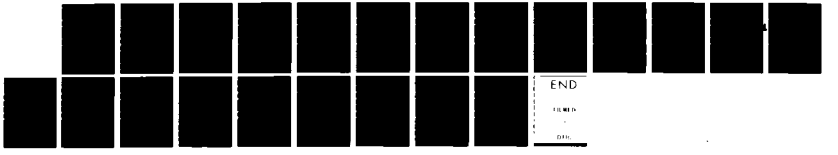
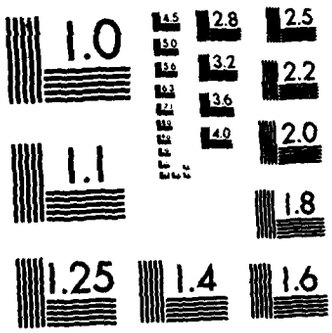




c. Create courses to educate users. (Determine present and future personnel needs.)

d. Develop, in an integrated manner with unit commanders and the Bureau of Training, a periodic follow-up and evaluation system that can verify use of knowledge acquired by personnel.

2. Maintenance

a. The concept of maintenance for a weapons system must be designed based on systems analysis, beginning with the early stages of project definition phases.

b. The maintenance concept should be defined on the basis of failures analysis, taking into account which will be taken care of by preventive or corrective action.

c. Upon defining the concepts SUPPLY-MAINTENANCE, one must produce.

(1) Personnel needs (quantity and training)

(2) Facilities' needs

(3) Specifications of technical documentation

(4) Levels of maintenance

(5) Needs for consummable and repairable spare parts.

d. Develop directives that will regulate administrative procedures related to maintenance.

e. Develop and control service contract execution for maintenance of equipment and/or subsystems.

f. Keep statistics of failures presented by equipment and keep up-to-date calculations of average time between failures.

g. Develop necessary material requirements to support planned maintenance.

h. Produce necessary technical documentation to support adequate maintenance.

i. Evaluate planned maintenance, propose and execute the modifications that will tend to optimize it.

3. Determination of Needs

a. The determination of needs must be done based on the antecedents obtained from analyses, to define the maintenance concept the new weapons submitted will fall under.

b. To make an accurate determination of needs a doctrine in the structural organization of the supply system must be established, as well as an administrative policy for inventory.

c. Levels of security must be defined and maintained, as well as those for requisitions and war for all spare parts that are carried on inventory.

4. System of Supply Materials

a. The Navy must have defined, established and coordinated strategies with regard to:

(1) Identification and documentation publications.

(2) Disposition of materials.

(3) Maintenance and repair.

b. Resources and possibilities at all locations must be used to advantage, prior to considering foreign suppliers.

c. Spare parts control inventory references must be assigned in accordance with the orientation given to the supply system.

d. Adequate control of spare parts, provisions and equipment in logistical, operational, armaments and engineering inventories must be maintained.

e. It is recommended that an actualized standardized catalog be obtained and kept easily accessible for all spare parts that make up the inventory.

f. Automatic (simultaneous) identification of all the parts that are capable of substitution and/or are interchangeable.

g. The development of inventory statistical data.

h. Automatic calculation of supply needs for spare parts and other supplies according to actual or projected demand.

i. The establishment and upkeep of up-to-date lists of suppliers of spare parts.

j. Automatic generation of purchase orders for spare parts, supplies and equipment for local and foreign suppliers.

k. Knowledge and information on spare parts, supplies and equipment that are in the process of being purchased from the time the original purchase order is issued until material is received in the warehouses or maintenance shops or other assigned location.

l. Create, evaluate and maintain a statistical data bank for decisionmaking regarding the Logistical Supply cycle.

APPENDIX A

QUESTIONNAIRE

1. Interviewee:

2. Position:

3. Years of Service:

Introduction:

Brief description of the investigation, its purpose and objectives. Acknowledgment of the assistance rendered by the interviewee for preparation of the thesis.

SUPPLY:

Critical opinion in relation to the system.

Most relevant deficiencies.

Suggestions that contribute to the optimization of the supply system.

MAINTENANCE: (Cause - Effect)

Problems you have observed in the actual maintenance system up to the third level.

What are the causes of the deficiencies.

What recommendations do you suggest for improvement of the maintenance system.

INTERPRETATIONS BY THE INTERVIEWEE:

All opinions will be used to infer situational problems, for the purpose of enriching the diagnosis.

Analysis of coincidental opinions by the interviewees.

Compilation of data provided by those interviewed.

APPENDIX B

SURVEY

1. Personal data:

1.0 Profession: _____

Position: _____

1.1 Status.

a. Single

b. Married.

c. Widow (er).

d. Divorced.

e. Separated.

f. Cohabiting.

1.1.2. Education:

a. Primary.

b. Secondary.

c. College.

d. Technical-Vocational.

e. Other.

1.1.3. How long have you been employed by DIANCA?

1.1.4. During your time of employment with DIANCA have you taken any courses?

yes_____ no_____

1.1.5. If your answer is yes, specify the type of course taken.

1.1.6. Do you use the knowledge acquired in your work?

yes_____ no_____

1.1.7. If your answer is no, explain why not.

2. Functional Structure of DIANCA:

2.1. Are you familiar with the storage system for spare parts stock at DIANCA?

yes_____ no_____

If your answer is no, explain why not.

2.1.1. Do you believe the existing stock of spare parts at DIANCA is adequate for the needs, at the third level, of naval units?

yes_____ no_____

If the answer is no, provide an explanation.

2.1.2. Why do you believe the navy utilizes DIANCA's services for maintenance and repairs?

2.1.3. What type of naval units are repaired at DIANCA?

2.1.4 What preferential treatment do naval units receive in comparison to commercial ships for entrance to Dry Dock?

2.1.5. Do you consider naval ship maintenance to be more important than commercial ship maintenance?

2.1.6. To the best of your work knowledge, what are the causes that most frequently influence repairs?

2.1.7. List, in their order of importance, the causes that delay maintenance at the Third Level.

3. Budget and Cost.

3.1. In preparing DIANCA's budget, what human resources intervene?

3.2. DIANCA's budget originates from which sector?

a. Public.

b. Private.

c. Mixed.

d. Other.

3.3. Does the budget allocated for maintenance and repair of Naval ships, up to the Third Level, cover the requirements?

4. DIANCA: Stock Control:

4.1. How are controls over existing stock of spare parts exercised at DIANCA?

4.2. What do you consider to be the deficiencies in the existing stock of spare parts at DIANCA?

4.3. How do you feel these deficiencies can be corrected?

4.4. How would you store stock, by type or by category? Explain your answer.

4.5. How would you classify the technical-administrative personnel that work at DIANCA?

a. Outstanding.

b. Excellent.

c. Good.

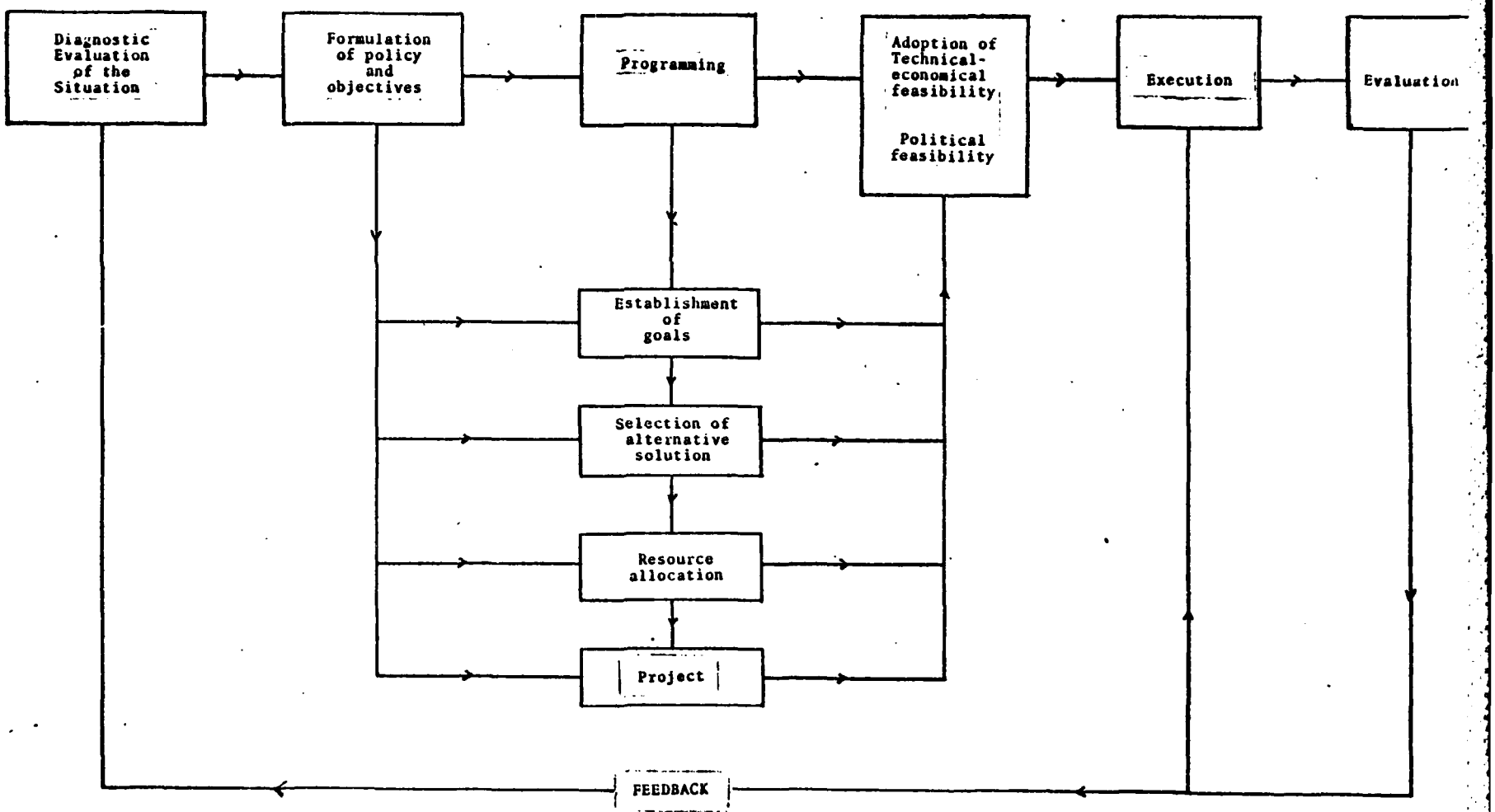
d. Marginal.

e. Unsatisfactory.

APPENDIX C

FIGURE I

ORIENTATION CHART



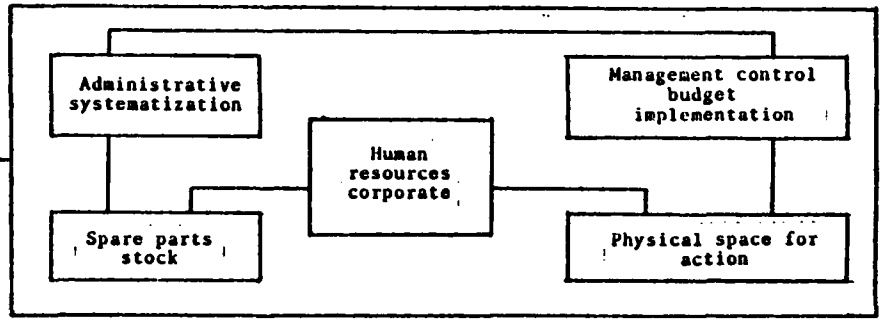
APPENDIX D

OPERATIONAL RANGE

Level of maintenance	Fleet	Units	Material
Third level	Frigates (type "Mariscal Sucre")	6	
	Destroyers	2	
	Submarines	3	
	Patrol Boats	6	
	Helicopters AB 212 ASW	6	
	Sailing Ship	1	
	Tracker planes	6	
	Support units (Transports, Tugboats, Hydrographicals, Floating-Dry Docks, Towboats.)	14	
		44	

Supply of materials for maintenance at the third level (Design)

Administrative Range



APPENDIX E

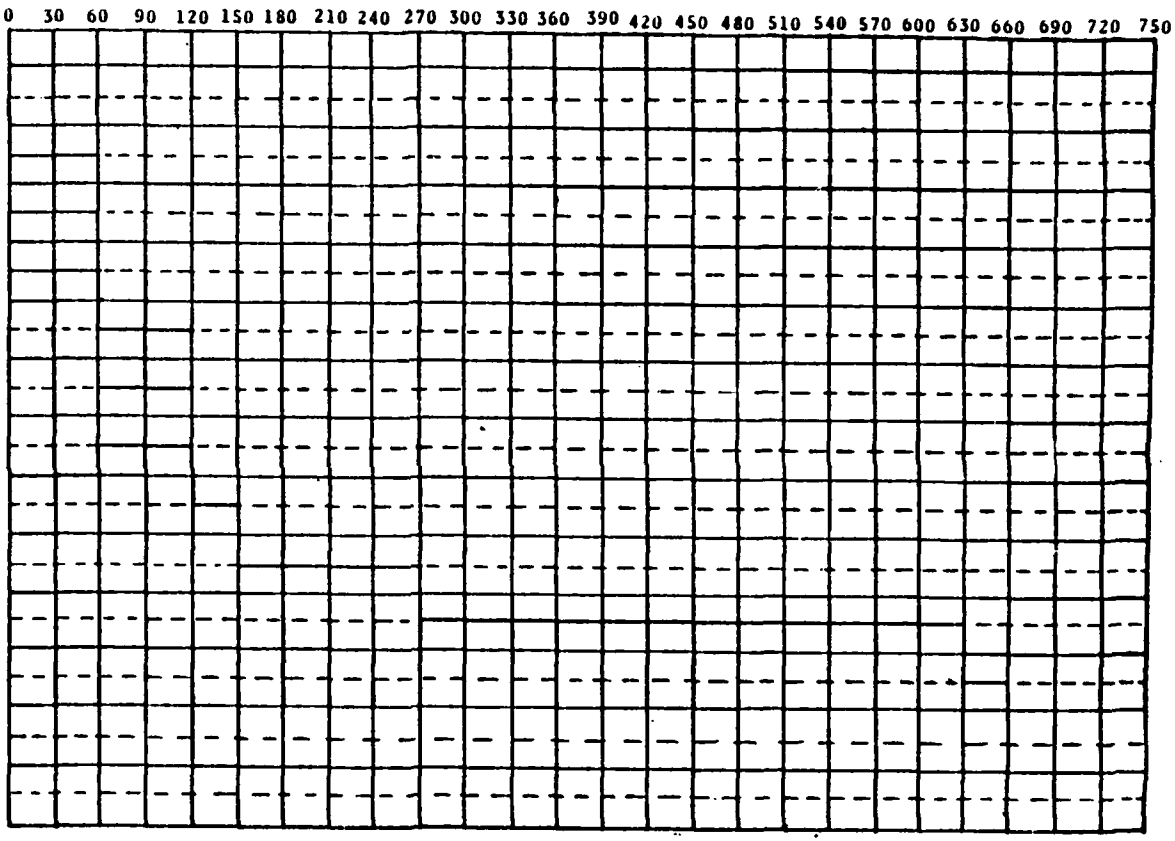
GUIDE TO FORMULATION AND APPLICATION OF THE MODEL

	Application to the project			Diagnosis of previous activities		Specific project objectives	Alternatives and Strategies
				Description (who performed, in what manner and with what results.)	Evaluation		
COURSE	Orientation		A	Supply of materials for maintenance at the third level for naval units.	Slow process which requires units remain in Dry Dock for longer periods. Misuse of possibilities for joint planning and execution *policy should* be adapte to need.	Determine internal and external factors that affect supply and maintenance for the purpose of streamlining procedures.	Organize coordination ma hanism between DIMA and DIANCA regarding purchases take measures to optimize administration.
	Establish relationship with	who determines policy	B	Policies established by the Navy there is no coordination with DIANCA.			
		DIMA	C	Occasional dialog exists with DIANCA they are not integrated into the supply system.		Reduce repair cost to the maximum	Avoid use of intermediaries take maximum advantage of units stay in Dry Dock.
		DIANCA	D	Is not only available for maintenance of naval units but also for Merchant Marines and other embarcations.			
RESOURCE ALLOCATION	Human Resources	Recruitment and selection	E	Recruitment done independently in accordance to each *Institution's* interests.	Resources are not used advantageously and thore is exodus of Naval personnel due to low wages. Lack of initiative in search of motivations. short ages in budget Capacitation does not correspond to interest by personnel or DIANCA's needs.	Streamline entry of units to Dry Dock for maintenance at the Third Level.	Program maintenance with two year anticipation. Timely supply of spare parts. Employment of qualified human resources.
		Adaptation and Optimization	F	Capacitation is scarce and directed to a reality alien to National and International industry.			
		Motivation and promotion of personnel	G	Lack of stimuli, an exodus exists.			
	Material Resources	Acquisition	H	Spare parts lacking with regard to needs. The great majority are imported. Larger budget.		Preclude misuse of funds	Direct importation
		Adaptation and Optimization	I	The Dry Dock is not optimally utilized. Need for modern equipment purchases exists.		Obtain pertinent and timely information on spare parts needed.	Department heads of units must elaborate list of required parts and provide timely information. Acquisitions List of priorities.
		Maintenance	J	Good maintenance service on equipment. Supply sheds needed.			
INFORMATION	Collection and Registration		K	Information obtained at DIMA and DIANCA thirt--three interviews conducted, and 94 personnel surveyed.	No good information mechanism exists at the different levels.	Training of personnel	Utilize technical training organisms and provide scholarships to other countries.
	Processing		L	Factors for planning with DIANCA were determined.			
	Procedures		M	Exchange of information with DIANCA and DIMA.		Create sources for employment	That Dry Dock reach complete use of its installations through contract qith the Navy and the Merchant Marine.

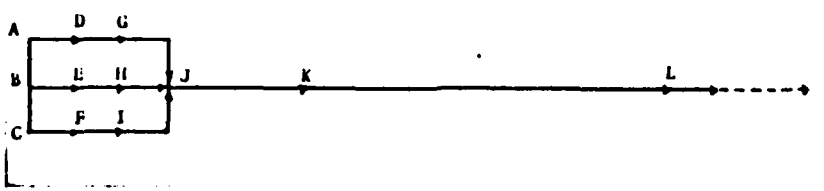
APPENDIX F

CHRONOGRAM AND FLOW CHART FOR PURCHASES OF MATERIALS TO EFFECT MAINTENANCE TO THE THIRD LEVEL ON NAVAL UNITS

Actual	Section	Duration
	A B C	Days
A	D	60
B	E	60
C	F	60
D	G	60
E	H	60
F	I	60
GHI	J	30
J	K	120
K	L	360
L	END	30
Leeway		60



—— = 30 days



A. List of engineering spare parts.

B. List of arms spare parts.

C. List of operations spare parts.

D, E, F. Logistical revision at Naval Headquarters.

G, H, I. Warehouse revisions by DIMA Puerto Cabello.

J. Purchasing process within Venezuela and in the exterior, obtain letter of credit.

K. Purchasing through confirmation or for stock.

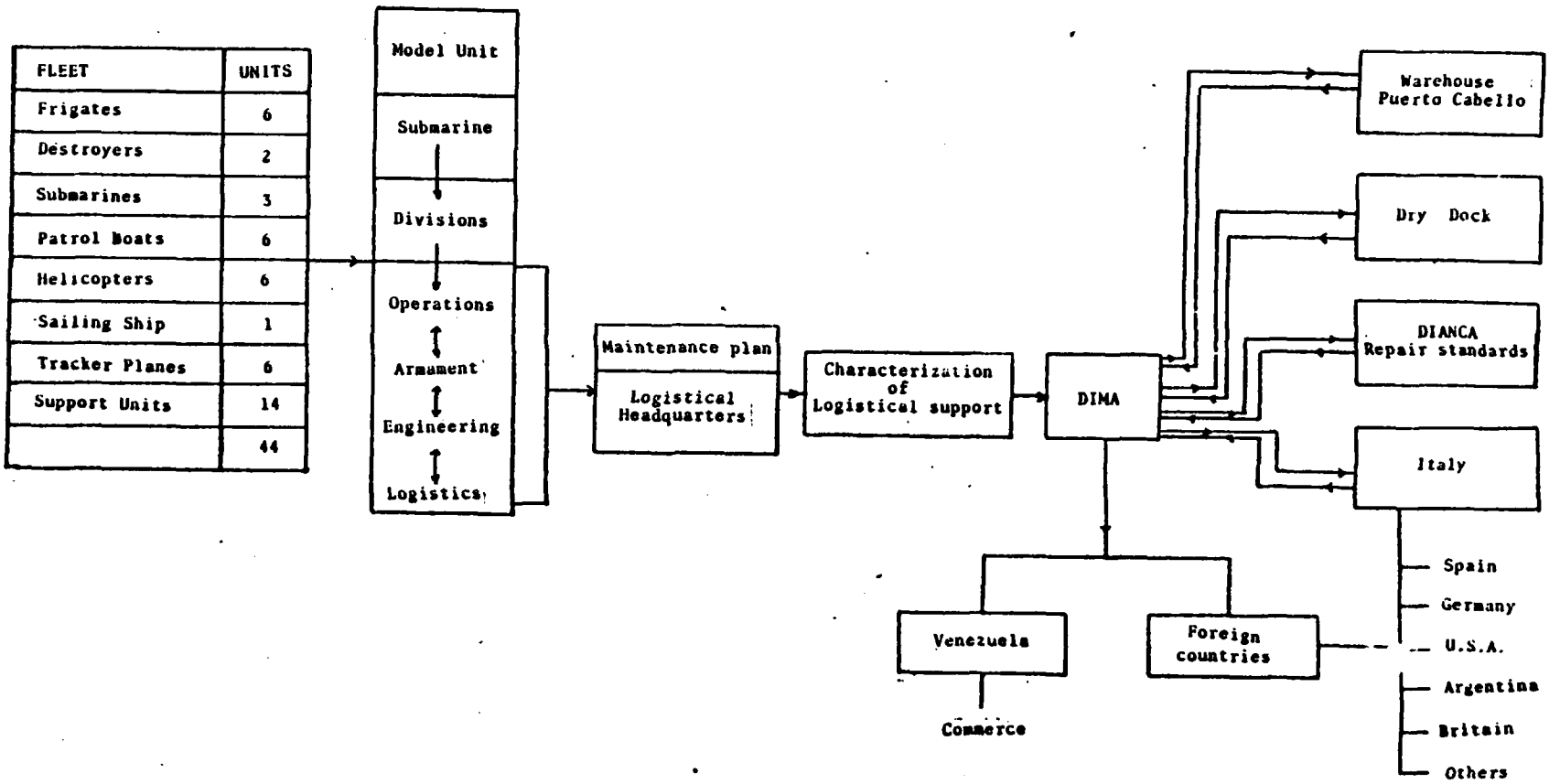
L. Transport and storage in Puerto Cabello spare parts to be delivered to DIANCA for maintenance up to the third level.

APPENDIX G

DYNAMIC OF THE MATERIAL SUPPLY FOR MAINTENANCE UP TO THE THIRD LEVEL

(model unit is a submarine)

FLEET	UNITS
Frigates	6
Destroyers	2
Submarines	3
Patrol Boats	6
Helicopters	6
Sailing Ship	1
Tracker Planes	6
Support Units	14
	44



APPENDIX H

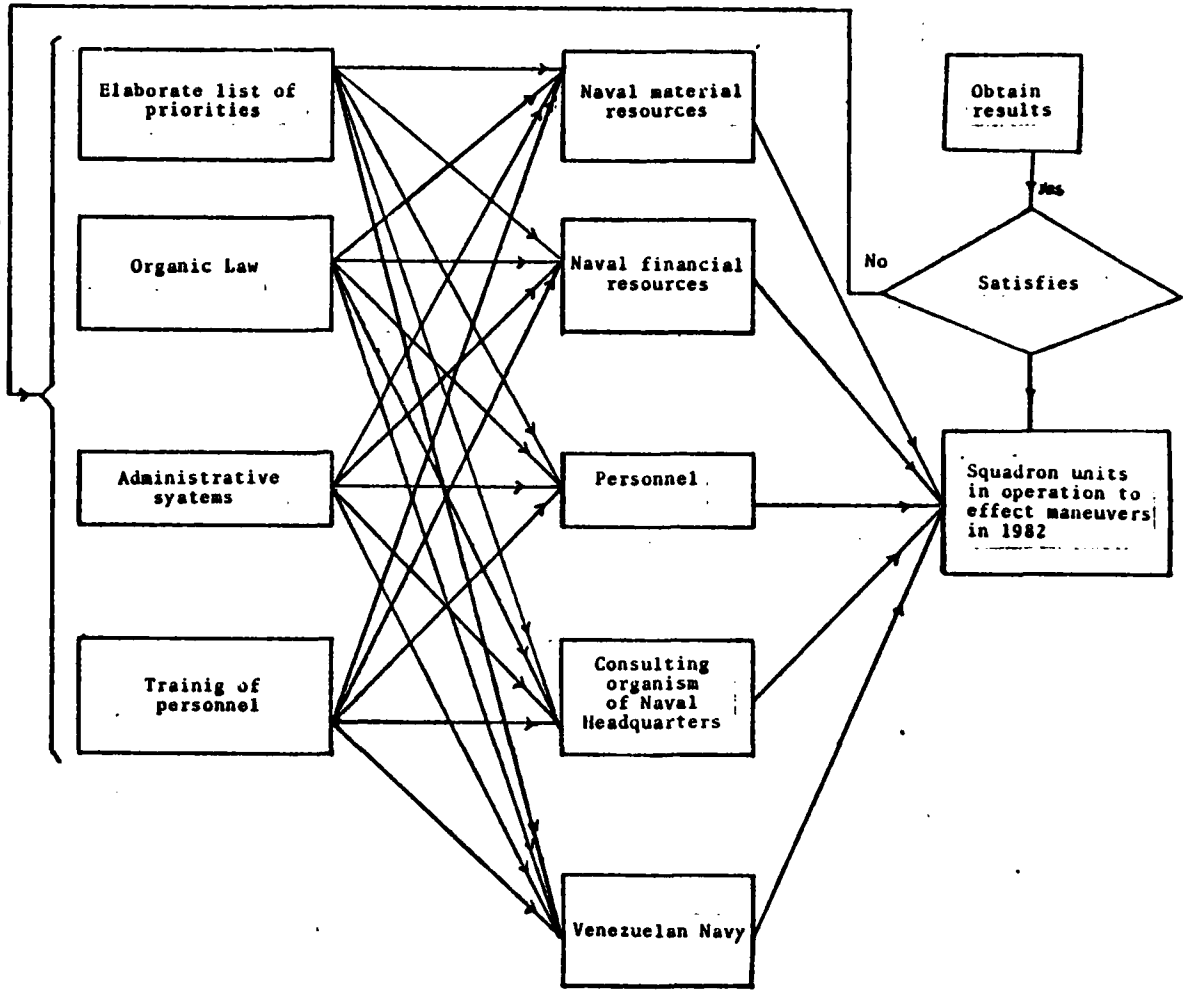
FIGURE IV

ADMINISTRATIVE MODEL FOR SUPPLY OF MATERIALS FOR MAINTENANCE AND REPAIR TO THE THIRD LEVEL

Political parameter / Administrative Axiom	Naval material resources	Naval financial resources	Personnel	Advisor to the Naval Operations Chief.	Venezuelan Navy
Training of personnel	Training of personnel assist planning the acquisition of supplies.	Training of personnel is indispensable for useful administration of financial resources.	Training of personnel influences i.s efficiency.	Training of personnel aids advisory functions at Staff Headquarters for decision making.	Training of personnel provides technological progress to the Navy.
Naval administrative system	The Naval administrative system must insure that there are sufficient material resources.	The Naval administrative system must plan financial resources.	The Naval administration system must establish the hierarchy of existing positions in its organizational structure.	The Naval administrative system must supply necessary information to the advisory branch of the Naval Operations Headquarters.	The Naval administrative system is indispensable for smooth operation of the institution.
Organic Law of the Armed Forces	The Armed Forces Law must be utilized for planning of material (supply) needs for the Navy.	The Organic Law must be utilized in everything concerning the distribution and utilization of financial resources	The Organic Law must be utilized for the definition of assignments and promotions of personnel.	The Armed Forces Organic Law must indicate the functions and attributes of the advisory branch to the Naval Operations Chief.	The Armed Forces Organic Law must define everything that concerns the Navy.
Elaboration of a list of priorities	The elaboration of a list of priorities simplifies the acquisition of materials for the Navy.	The elaboration of a list of priorities facilitates distribution of financial resources.	The elaboration of a list of priorities is indispensable for adequate selection of personnel.	The elaboration of a list of priorities to advise the Naval Operations Chief is necessary to make better decisions.	The elaboration of a list of priorities is indispensable for the development of the Navy.

APPENDIX I

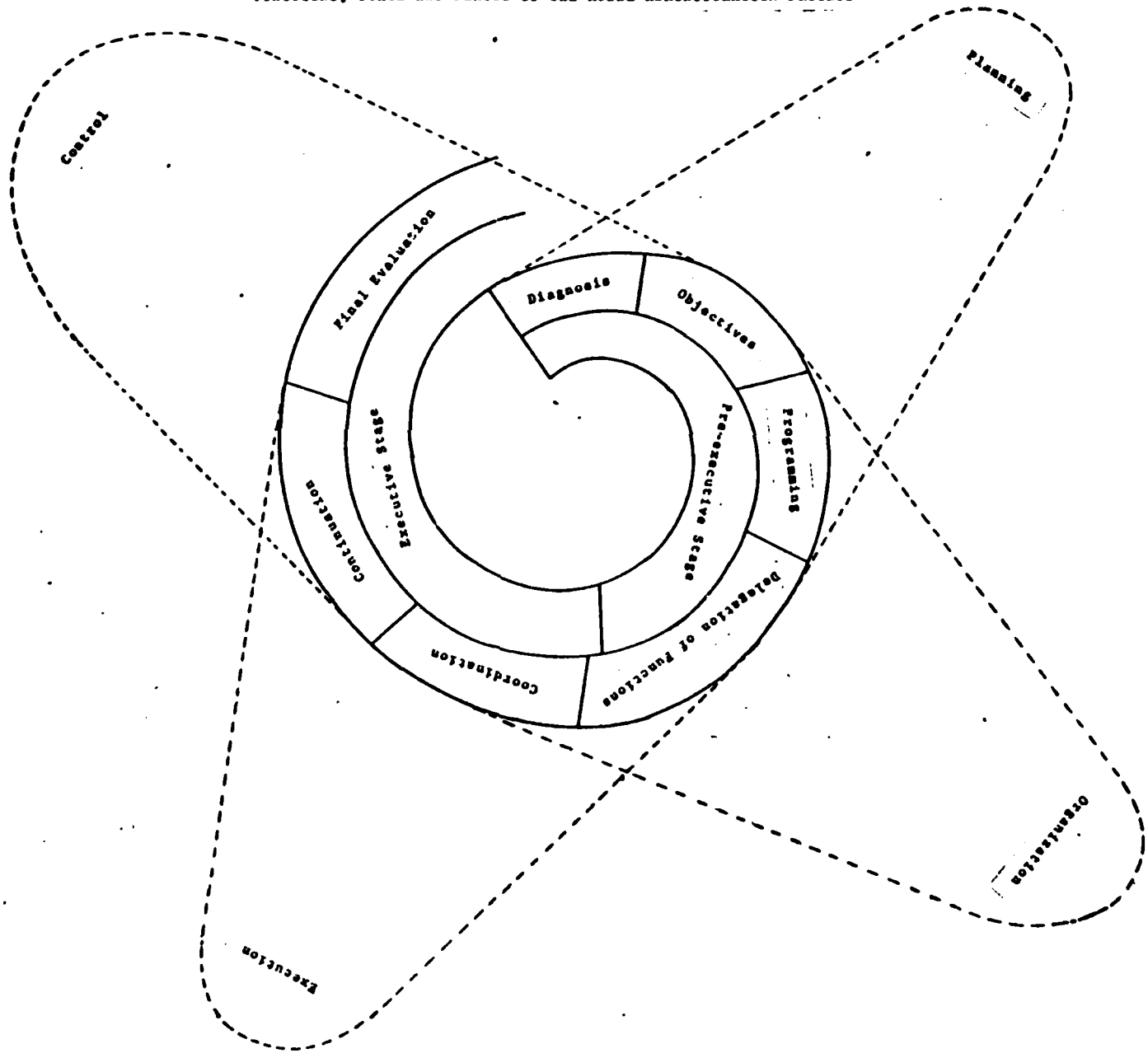
FLOW CHART FOR ADMINISTRATIVE MODEL FOR SUPPLY OF MATERIALS FOR MAINTENANCE AND REPAIR TO THE THIRD LEVEL



APPENDIX J

GRAPH II

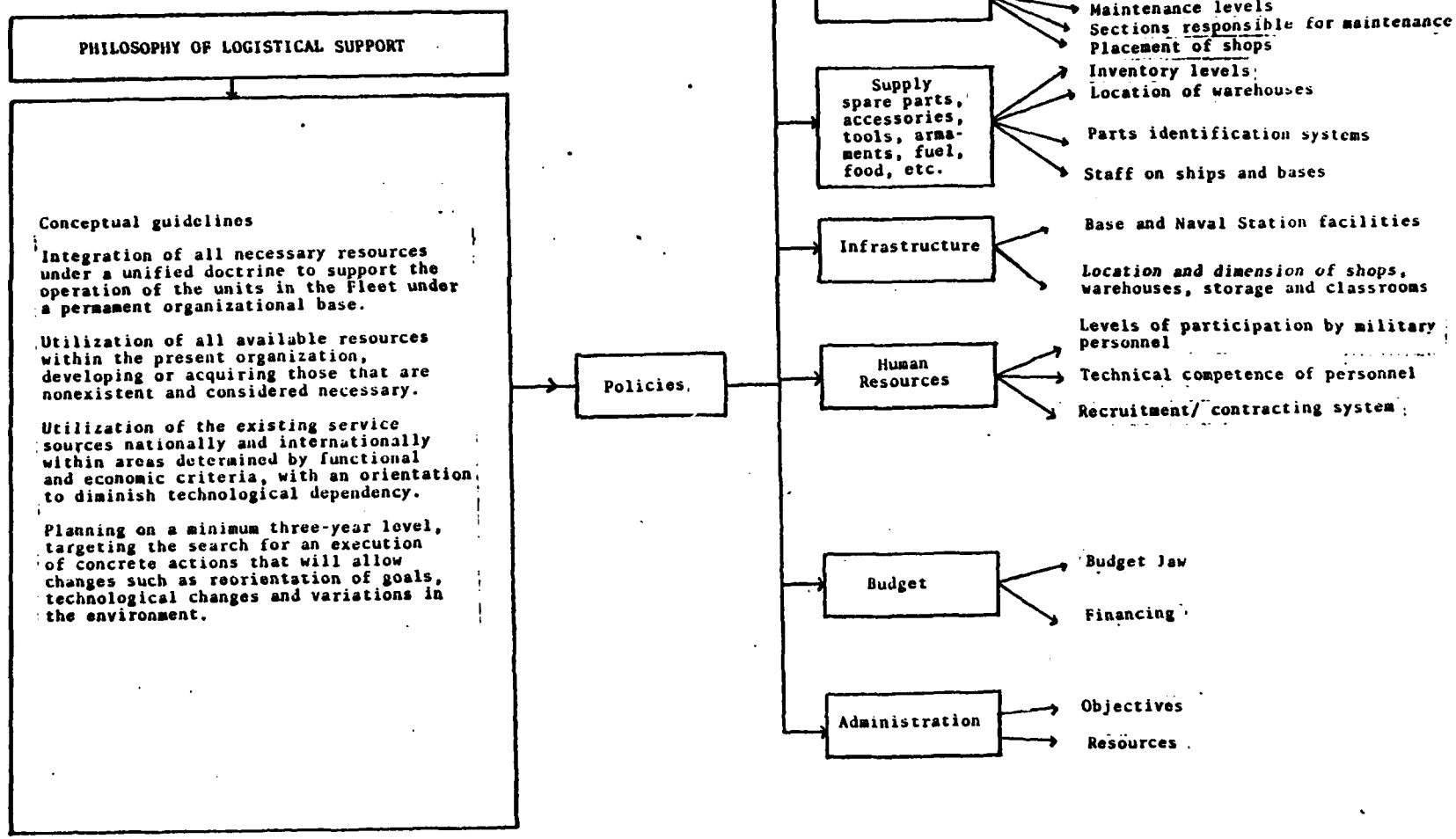
FUNCTIONS, STAGE AND PHASES OF THE MODEL ADMINISTRATION PROCESS



APPENDIX K

EXHIBIT I

PHILOSOPHY OF LOGISTICAL SUPPORT



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